AIR ENGINEERING

JUNE, 1959

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- *Ventilating the World's Largest Grey Iron Foundry*
- *Dust Control Methods for Uranium Ore Processing*
- *Practical Tips for Make-up Air Trouble Shooting*

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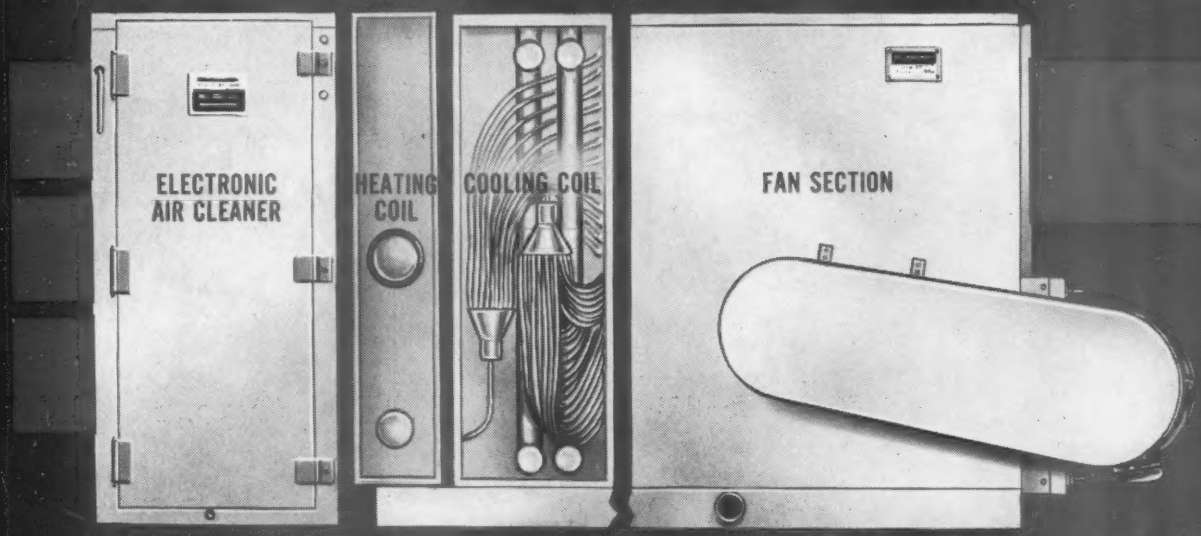

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AIR ENGINEERING

VOL. 1, NO. 3 JUNE, 1959

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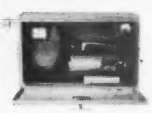

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Letters

Editor:

You and your staff are certainly to be congratulated on a very fine new magazine. We at Continental wish you every success in this new venture.

Sidney S. Emison
Assistant Sales Manager
Continental Air Filters, Inc.
Louisville, Kentucky

Editor:

Congratulations on the first issue of AIR ENGINEERING. I took it home with me over the weekend and read it from cover to cover. You are doing an excellent job and I hope that the good work continues.

Best wishes for your future success with AIR ENGINEERING.

Leo P. Flood
Chief Engineer
City of New York
Department of
Air Pollution Control
New York 38, N. Y.

Editor:

We are charter subscribers to AIR ENGINEERING and we congratulate you on the good appearance of this new publication.

W. G. Hazard
Industrial Relations Division
Owens-Illinois
Toledo 1, Ohio

Editor:

Thank you for the complimentary copy of AIR ENGINEERING. It looks very good, and you have my very best wishes for its complete success.

Byron R. Hubbard
Chief Industrial
Hygiene Engineer
State of California
Department of Public Health
Berkeley 4, California

Editor:

Reaction to the first issue of AIR ENGINEERING has been one of interest. Several articles seem to consolidate information previously somewhat scattered. The publication promises well and has (our) good wishes for a successful life.

Wm. F. Reindollar, Sc.D., Chief
Division of Occupational Health
State of Maryland
Baltimore, Maryland

Editor:

I believe your new publication will do much to make many more engineers and key executives more aware of plant air pollution, etc.

Paul A. Merrill
Stewart & Prince, Inc.
Georgetown, Mass.

Editor:

Congratulations on your first two issues of the splendid new publication AIR ENGINEERING.

It is a long needed contribution to the available literature and I am sure will uphold the highest professional interests of the practice of industrial hygiene.

Perhaps it will serve to snap some of the more near-sighted communities out of their lethargy as regards some of our air pollution problems. Best wishes for your continued success.

Robert E. Earhart
Industrial Hygienist
Goodyear Atomic Corporation
Portsmouth, Ohio

COVER

The 30 cu. ft. of air each adult needs for breathing each day is being modified extensively the world over. Our cover is a graphic display of what's happening.

The UNESCO *Courier* for March, 1959, published in English, French, Spanish, and Russian, which featured the world-wide air pollution problem, said, "Just as we no longer throw rubbish into the street, we shall eventually cease to discharge smoke and other *filth* into the air. It is high time we stopped using the air we breathe as a sewer."

Correction

In the article entitled "A Collection Report on a New Type Wet Scrubber" which began on page 23 of the April issue of AIR ENGINEERING, we wish to correct a typographical error. On page 51, the second to the last line in this article read: " . . . using water quantities of approximately 3½ gpm/1000 cfm and combined air and hydraulic hp requirements of about 1.3 to 2.5/100 cfm, based on the high pressure spray system." The latter figure in this sentence should have read " . . . 1.3 to 2.5/1000 cfm . . . "

Paper Producer's Pilot Plant Demonstrates New Processes Which Eliminate Stench and Water Pollution

Aimed at removing the "rotten egg" smell generated by paper plants, The Consolidated Water Power & Paper Co. last month unveiled a $750,000 commercial pilot plant at Wisconsin Rapids, Wis., which it is hoped will demonstrate new capabilities in removing two major objections to paper mills, the stench and water pollution.

The new development, it was stated, comes after more than 20 years of step-by-step research by Western Precipitation Corp. Satisfied with tests and the operations at the pilot plant, Consolidated is reported ready to spend $3,000,000 more putting the process into operation on a full commercial scale.

Processes involved are varied and quite intricate, and at the present they are considered practical for only those mills which have more than 100 tons a day capacity.

Smog Blamed for Carolina Power Blackout

Acid-laden smog has been blamed for an electric power failure which threw parts of the area around Charleston, S.C. into an electrical blackout one day last month.

The power went off when four large copper bus bars were burned out in a massive short circuit. "This happened when smog, filled with acid collected from industrial plants near the company's Hagood plant, coated insulators protecting the bus bars," stated Harold A. Petit, vice president, South Carolina Electric & Gas Co. Bus bars are used to carry current from generators to transformers at substations. When the insulators became coated, a short circuit or flash-back occurred. Visible and audible in many areas, the flash burned out all four bus bars and interrupted the flow of power.

Pollution Problems May Make Man Extinct Before He Realizes It

Slow, long-range effects of air pollution, radiation, new chemical products of unknown toxicity, and water shortages could seal man's fate "20 or more years before the development of symptoms," warned Dr. David E. Price, assistant surgeon general, U.S. Public Health Service, at the 1959 Industrial Health Conference held recently in Chicago.

But Dr. Price is convinced this shadow of mankind's possible extinction "is in reality the darkness preceding the dawn of the greatest era of progress man has ever known."

Industrial hygienists may hold the key, he believes, because their concern about gradual deterioration in the worker's health that may result from prolonged small-dose exposure to toxic materials is "precisely the concern of those responsible for controlling the general community environment."

$2 Million Duct Collecting System for Phelps Dodge Plant

Completion of a $2,000,000 dust collecting system in the Phelps Dodge Copper Products Corp. plant in Queens County, L.I., N.Y., is expected late this summer.

Medical Field Finds "Good" Air Can Stop Disease But "Bad" Air Promotes Disease

"Air" was very much in the limelight in the field of medicine during the month of May – and in both a good and a bad light. On the plus side, papers given at the National Tuberculosis Association convention (1) told how properly treated air apparently prevented the spread of Asiatic flu in Army barracks, (2) how air was used as a vaccination medium in place of the traditional needle to immunize against tuberculosis, with the possibility that this technique could be extended to other airborne communicable diseases. (See "News of the Industry.")

On the minus side, more medical authorities continued to point to air pollution as a major factor in the growing incidence of certain types of diseases. Dr. Richard A. Prindle, chief of the U.S. Public Health Service's air pollution medical program, was quoted as saying that the Health Service has "evidence that indicates a relationship between air pollution and cancer of the stomach, lungs and esophagus," and that "air pollution poses a medical and public health problem of enormous scope."

A London heart specialist, Dr. John Goodwin, visiting in Los Angeles, declared that "when a bad smog comes down, we expect an increase in the number of patients with chronic lung and heart diseases who will be thrown into acute attacks within a few days. In London, he said, coronary artery disease victims are advised to keep indoors and seek immediate treatment if a chest cold develops.

Mechanical Contractors Group Nixes Merger With Plumbers, Probe Job Responsibility

Proposed merger of the Mechanical Contractors Association of America with the National Association of Plumbing Contractors is "off" and it may be some time before negotiations seeking to combine the two groups will be resumed.

Much emphasis was placed on air conditioning by the mechanical contractors at their annual convention, and concern was evidenced over where "job responsibility" should lie – as between general contractor, consulting engineer, and architect, when the mechanical contractor is doing the air conditioning work as a sub-contractor. (See News of the Industry.)

Louisville Regulations Seen Covering Gas Tank Vapors, Fly Ash, Industrial Dusts

New air pollution control regulations for the Louisville, Ky. area were expected to be issued sometime in June by the City-County Air Pollution Control Board, following a $300,000 study.

According to Ralph W. Bourne, the board's chief engineer, the new regulations will probably cover (1) vapors which escape from gasoline storage tanks; (2) fly ash produced by the burning of coal; (3) dust from industrial processes.

Standard Steel Corp. Acquires Cambridge Co.

Standard Steel Corp. has acquired the assets of the Cambridge Co. of Lowell, Mass., from Carrier Corp., and Cambridge will become an operating division of Standard Steel, which has its headquarters and manufacturing facilities in Los Angeles, and another plant in Decatur, Ill.

"Basic motivation behind our investment in Cambridge Co. is to integrate the engineering know-how and background of Cambridge with the manufacturing techniques of Standard Steel," states Robert S. Burns, president of the company. "It is our intention to continue the operation in Lowell and to supplement certain areas of activity with the manufacture of certain proprietary items, such as industrial dryers and asphalt batching plants."

AIR ENGINEERING

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EDITORIAL:

Community Climate Affects Favorable Advancement of Air Engineering

GRANTED that air pollution control is a worthy activity, that it benefits personal and community health, that it makes clean-air cities better places in which to live and work. How can industrial hygienists and public enforcement officials best promote its acceptance?

Publicity is a foremost requirement, of course. Citizens *need* to be better informed about the dangers of polluted air. Trouble is, air pollution research people have never decided just what these dangers are! True, there's some agreement about deaths at Donora, morbidity of London smog, lachrymosity of Los Angeles air. But even for these *obvious* air poison cases, it is all but impossible to make a clear cut medical diagnosis.

We all know that industrial hygienists have established Minimum Allowable Concentrations (MAC's) for almost every toxic fume, dust, or gas for *inside buildings*. These MAC's are based largely on animal experimentation and are for an eight hour exposure.

We urgently need MAC's for *outside* air . . . for a 24 hour exposure . . . for every day of the week. *Some* of us may be in factories or offices eight hours a day, but *all* of us breathe air 24 hours each and every day. And we need MAC's not just for a given vapor, fume, aerosol, or particulate substance, but MAC's for *combinations* of these individual air pollutants found in the average industrial community.

A good pedestal of Community Conscience can provide a spring-board for fouled-air elimination programs. It's all part of a package.

Being "on the side of the angels" – and recognized as part of a general movement toward civic upgrading – clean air crusades will be better accepted than if they are presented hat-in-hand, like a street beggar with pencils and tincup, as an isolated phenomenon.

Ideal situation would be that of enfolding an air pollution control drive into a Community Chest – along with over-all fund solicitations for hospitals, orphans, the mentally ill, Boy Scouts, cancer and heart research, etc. This sort of thing probably is an impossible dream, but the idea is worth contemplating.

And as an idea it has its practical side. The Community Chest is devoted to making life better for the entire community. The average air pollution control department is usually, fund-wise, on the short end of the stick, with precious little if any money available for community-wide publicity – the kind of publicity that will needle industrial management into becoming *conscience-stricken* about their responsibili-

(Please turn to following page)

NEWS of the Industry

Rubber Goes To Pieces In Smog, Chemists Warn

Ozone, one of the principal ingredients of smog, came under fire as a factor that produces fast deterioration of rubber products, in two discussions before the 75th annual meeting of the American Chemical Society's Division of Rubber Chemistry in Los Angeles last month.

"Even in localities of average ozone concentration, unprotected rubber under strain will show surface cracks in a day," declared Dr. William L. Cox, a chemist for Universal Oil Products Co. "In areas where the ozone content is high, the same article may crack after less than an hour's exposure."

Fortunately, said Dr. Cox, the makers of tires and other rubber goods have devised new chemical "anti-ozonants" which, when mixed with raw rubber, come to the surface of the finished product and protect it against ozone. Without this, he said, new tires in dealers' showrooms might start to crack before the cars were sold, and brake hose and other rubber parts might fail within six months.

A three-year research project conducted by Army engineers in Pasadena showed that after only two to three weeks' exposure, deep cracks developed in tires, windshield wiper hoses, and rubber bumpers not properly protected.

Rubber parts protected by anti-ozonants stood up for a year, and sometimes two years in Pasadena. This compared with a life of three to five years in other areas.

APCA Proposes Changes In Dues, Memberships

Certain changes in classification of memberships, and increases in the dues structure of the association, have been proposed by the board of directors of the Air Pollution Control Association, and will be discussed at business sessions during the association' annual convention in Los Angeles.

In a bulletin putting these proposals before the membership, the directors stated that ". . . the board has taken every means within its power to hold costs to the minimum, but it is clear that unless the membership approves the increase in dues, we shall be forced to curtail and perhaps eliminate some of our services. We do not believe that the members wish the organization to be less active."

Two new classes of membership, governmental and organizational, are proposed. Governmental members would include such organizations as air pollution control agencies, health departments, municipalities, and public health services. Organizational members would include those not falling into the categories of company or governmental memberships.

Proposed amendments to the by-laws would permit an increase in dues for individual members from $10 to $15, and an increase in dues for company, governmental, and organizational membership from $50 to $100.

Following discussion at the convention, the proposed changes will be submitted to APCA members by letter ballot.

EDITORIAL

(Continued from preceding page)

ties in this regard. So funds from the Community Chest drive could well be earmarked for public relations efforts toward cleaning up the air shared equally by all. We have a "Cleaner City" week . . . why not a "Cleaner Air" week (or month, or year)?

Assumption of business citizenship responsibilities on the part of all employers in a community can be witnessed to and testified by the following conditions:

(1) Consistently good employer-employee relations;

(2) Courageous leadership in civic and political affairs on the part of executives;

(3) Happy home lives and healthy children.

All of these desirable elements, incidentally, are subject to business and engineering control. Community Climate is man-made. It is a priceless commodity which thrives on local, grass-roots efforts. It can be legislated into being; and it can be imported into a lethargic community.

As a corollary, air pollution control needs an atmosphere of good citizenship before it can arrive.

J & L PROMISES 'CLEAN' AIR IN CLEVELAND

The most modern equipment available for air pollution control will be included in a $50 million improvement program at the Cleveland Works of the Jones & Laughlin Steel Corp., it has been announced by J. R. Powell, works manager.

The steel company executive discussed the program with Cleveland's Mayor Celebrezze and city air pollution control officials. He said construction of two basic oxygen furnaces—largest in the world—plus one of the largest blast furnaces in the U.S. would put the Cleveland plant among the country's most modern steel-making facilities. Work is scheduled to start this summer and will take approximately 18 months.

Powell said old furnaces, as well as the new, would get modern air pollution control equipment.

California To Establish Auto Exhaust Standard

First in a series of proposed legislative measures which Gov. Pat Brown of California has requested to attack California's smog problem became a law last month when the governor signed a bill which requires the state director of public health to set up maximum permissible standards for the emission of exhaust fumes from motor vehicles by Feb. 1, 1960.

When such standards are established, local air pollution control districts, or the state, will be allowed to ban the sale of automobiles whose exhaust fumes exceed the state's standards or require the use of exhaust-control devices. The governor indicated that any state, county or municipal automobile exhaust control laws passed before such standards are determined would be unconstitutional.

Gov. Brown said he selected the Feb. 1, 1960 deadline with the thought that the automobile industry will have developed an anti-smog device by that time. He expressed the hope that automobile manufacturers could use the standard as a guide in design.

Who Has The Responsibility for Air Conditioning on Big Jobs?

Should the "ultimate responsibility" for the mechanical segment of a building contract rest with the architect, consulting engineer, or the general contractor?

This was one of the most debated subjects in a panel discussion on "Architect-Consulting Engineer-Mechanical Contractor Relationship on Air Conditioning Projects" carried out during the recent annual convention of the Mechanical Contractors Association.

Mechanical contractors taking part in the discussion made the point that there is often no "central point of control"—no place to appeal when they run into problems on the job.

Where an architect has been in the picture on a building contract, the question was asked as to whether or not he shouldn't bear this responsibility.

The architect on the panel responded by saying that in the old tradition this had been true, but that in the U.S. the "team" that did the actual work on the building was usually under the supervision of the general contractor.

However, with general contractors in today's order of things often being "brokers" or "wall builders" (as some of the mechanical contractors termed them), and the courts tending to place more of the responsibility for unsatisfactory work upon the consulting engineer or architect, the architect's representative said that those in his profession might have to take over more responsibility for the job.

Another major point made in the floor discussion was the general opposition to the "or equal" clause in specification of equipment to be used on the job ("lazy man's way of writing specifications").

Mechanical contractors don't want a single supplier specified. Most desirable to them is the naming of three or four makes for each major piece of equipment—these selected after consultation with the consulting engineer and contractors—with the bidder given the option of naming any one of them.

Both the consulting engineer and the architect said that in their viewpoint a principal desirable characteristic of a mechanical or air conditioning contractor is whether or not he has personnel who can "button up" and "balance out" the job.

"Proper balancing out and testing of a system is something that you can't write into the specifications," said the consulting engineer. "It's something an individual learns by experience and training, and 'feel' and if the installing contractor doesn't have such a man, he's in trouble."

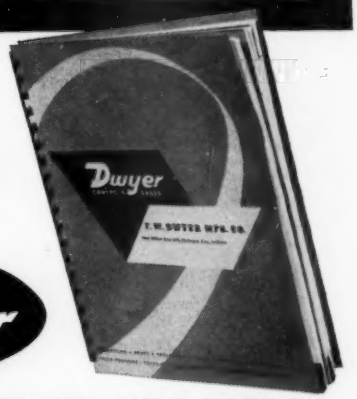
Some other observations on the "right" approach to a job by the installing contractor:

The contractor should not use the engineering drawings in actual field construction work. He should make larger drawings in his own shop, which drawings will fit the equipment in the allotted space. Drawings should be circulated to other crafts and commitments obtained on possible conflicts.

In the installation of air distribution systems and piping, these must be coordinated with such other phases as lighting and sprinkling systems. Diffusers should be placed symmetrically and fitted into the ceiling pattern. This should be planned before slabs are laid. Nameplate information should be placed on control panels, and identification tags on principal valves. Isometric drawings should be made of piping.

NEW GAGES NEW IDEAS

IN THE 1959



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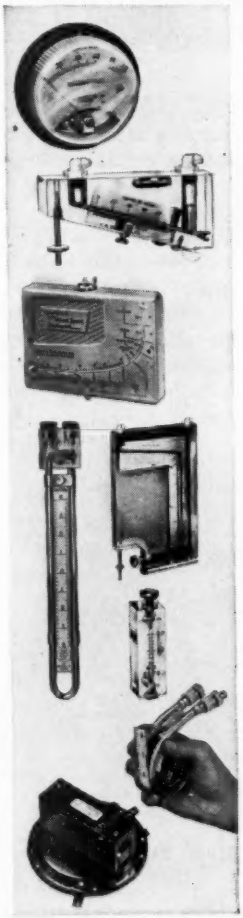

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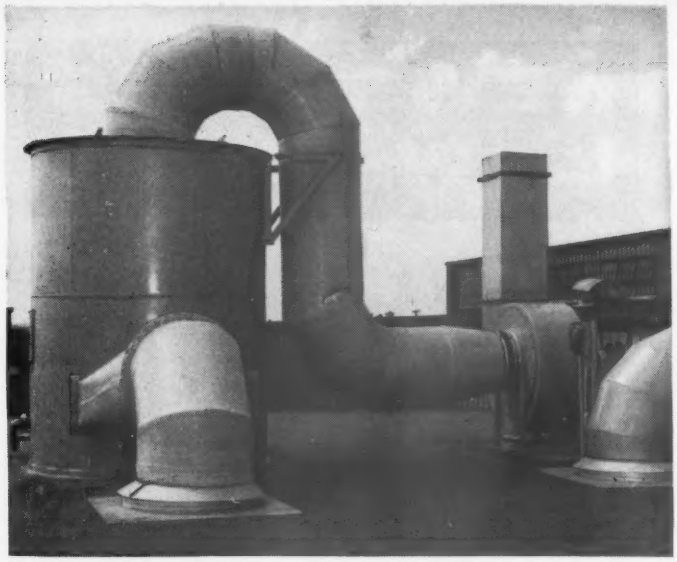

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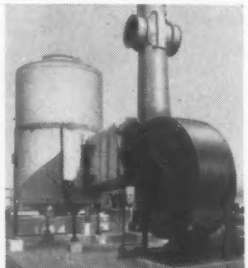

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News of the Industry...

(Continued from preceding page)

N. Y. Report Shows Controls Have Cut Pollution 30%

There was less air pollution in New York City in 1958 than in 1957, as air pollution is measured by control experts, according to the N.Y. City Department of Air Pollution Control annual report, issued last month.

This was true, said department officials, despite a slight increase in the amount of soot and ash that fell on the city, and in the oxidants and carbon monoxide from cars, trucks, and buses.

The diminished air pollution reflected a 30 percent decrease in the particulate material suspended in the air (as distinct from sootfall that settles out) and a reduction in the concentration of six of the eight major gaseous pollutants.

Reason for the improved situation was said by officials to be a stricter enforcement program on air pollution control laws, the enactment of a law prohibiting the open burning of scrapped automobile bodies and increased cooperation from industry.

Figures were given in the annual report for the first time on the amount of radioactive air pollution. These figures indicated only very low levels and did not point to any fall-out products of bomb tests.

Biggest enforcement effort in its history was reported by the N.Y. city agency. There were 7,544 summonses or nearly 200 more than in 1957; 4,293 violation notices, an increase of almost 1,600; and 417 office hearings, or 32 more than in 1957.

The used automobile burning problem has come close to solution, the report says, through the installing last year of three car incinerators capable of burning more than 40 cars an hour without polluting the air, and by the planning and starting of several similar units to handle 200,000 cars yearly.

'Airborne' Treatment Used To Stop Flu, Vaccinate for TB

"Air-borne" treatment methods were reported as being successful, at least in experiments carried out thus far, in preventing the spread of Asiatic flu and in vaccinating for tuberculosis, the National Tuberculosis Association was told at its convention in Chicago last month.

Meeting with the association was the American Trudeau Society, its medical section, which has been extending its research into lung and throat infections other than TB.

Ultraviolet light used to treat air in rooms apparently helped prevent spread of Asiatic flu in the Veterans Administration Hospital at Livermore, Calif. according to a study made by Dr. Ross L. McLean.

A group tested by Dr. McLean got as high as 67 percent reduction in the number of Asiatic flu cases at the time of the 1957 epidemic, in rooms which had the air treated with ultraviolet light.

What Dr. McLean and his associates believe is that ultraviolet rays, known to be destructive to certain bacteria and viruses, in some manner blocked the airborne transmission of the Asiatic flu virus.

A new way to be vaccinated—simply by breathing vaccine-containing air—was forecast in the report o

a study made to the National Tuberculosis Association.

Experimental work on guinea pigs and 30 humans indicates that breathing germ-laden air may be as effective as the conventional shot in the arm for the administration of BCG, the anti-tuberculosis vaccine.

Members of the medical profession making the report at the meeting stated that they can see no reason why the method could not be used for vaccinations against polio and other diseases.

The new airborne vaccination has been tried in University of Illinois College of Medicine laboratory in Chicago. Placed in a closed room for half an hour, 30 subjects breathed air which had been sprayed with BCG. Later examination showed that the vaccination "took" for 27 of the subjects.

Dr. Gardiner Middlebrook, who did the animal experiments at the National Jewish hospital in Denver, said that it took only a few of the inhaled germs to produce immunity. Only 25 germs were necessary in the airborne vaccination as against the million needed for injection, he declared.

Declaring that the technique is safe and painless, Dr. Middlebrook commented that "it is unnecessary to elaborate on its convenience as a method for individual or for mass vaccination."

Union Backs Contractors on Plant Maintenance, Alterations

"Both contractors and labor unions should center attention on selling production firms on the wisdom of contracting out their alteration, and major maintenance and repair work, as well as any new construction in which they may engage," General President Peter T. Schoemann of the United Association told the Mechanical Contractors Association at their annual convention.

Schoemann said that "I am convinced that we can prevail on these plants to use our services rather than their own—for one reason, the changing realities of industrial life are running in our favor."

One phase of the "changing realities," said the union official, is the trend towards greater automation, with improved machinery, and very little need of maintenance mechanics most of the time.

Instead, there is an urgent periodic need for large numbers of mechanics, from time to time, when production units are taken off stream on a regular basis for repair, renovation, and improvement. There also is a need for large crews in emergencies.

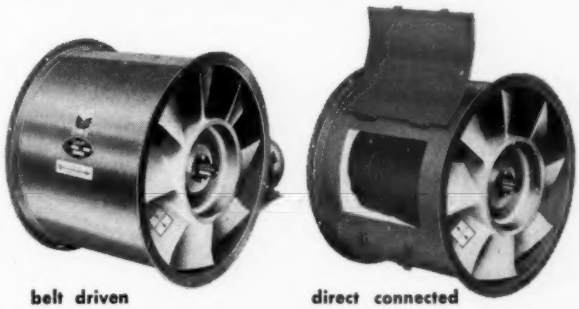
Describing a particular manufacturing plant of this nature, Schoemann said that "it was obviously poor business for the company to keep these mechanics on a steady payroll if some reliable alternative could be found.

"And it was found. Through our contractors, the UA and other craft unions agreed to make their members available from our local unions at building trades rates to perform this necessary turn-around work. All major maintenance and alteration was contracted out by the plant, and our men instead of the industrial union members got the work."

Schoemann told the contractors that "we will insure the availability of our men for maintenance work at building trades rates to all signatories of the UA National Maintenance Agreement, to all members of the National Constructors Association, and to all other contractors signatory to our National Construction Agreement."

high speed - high efficiency

Aerovent's new Tubeaxial Fan, designed around a new 8-blade "Macheta" Airfoil Axial Flow Propeller, offers top performance against medium pressures at speeds to 3450 RPM. Available in 16", 18", 24", and 30" diameters, this unit combines speed, stamina and modern functional design. Easily installed in present ductwork or engineered to new construction, it's the right answer for resistances to 4" SP. Another outstanding development from Aerovent—America's finest industrial fans and air equipment.



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NEWS of the Industry . . .

(Continued from preceding page)

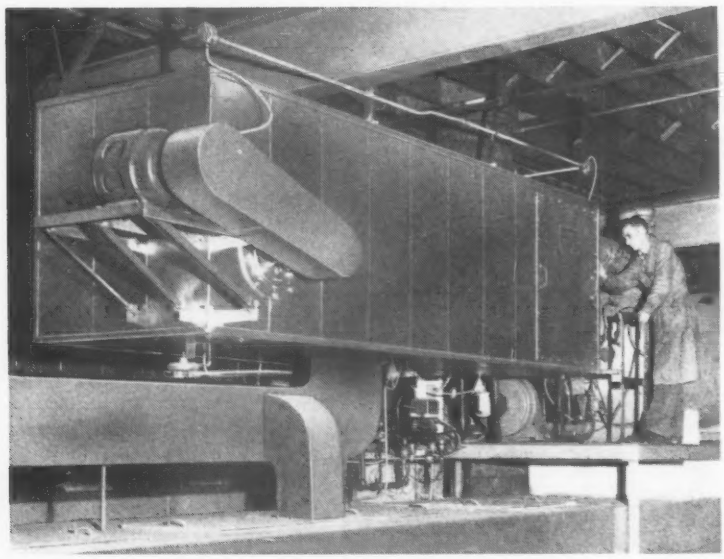
Torit Boosts Plant Facilities in St. Paul

Nearing completion in St. Paul is a new plant to consolidate operations now carried on at three separate locations for Torit Mfg. Co., manufacturer of industrial dust collectors.

The new building will increase the company's manufacturing and engineering facilities by about 25 percent, William L. West, Torit president, has declared.

The company makes a wide range of dust collectors, which are used primarily in metalworking or woodworking operations. More than 40,000 Torit dust collectors are now in use in American industry, more than have been produced by any other company, West claims.

PARTNERS FOR PROFIT



Hydrocarbon exhaust vapors and catalysts form a partnership that provides low cost heat and safety for industrial processes.

The catalyst releases heat without flame, often several hundred degrees—from vapors usually considered too dilute to have value. Simultaneously the catalyst effectively eliminates noxious odors and hazardous condensate to provide a safe, inoffensive and often useful exhaust emission.

Hundreds of plants are saving fuel today with Catalytic Oven Heaters, and other types of catalytic combustors.

Consult your Oven Builder or write us direct for details on lifetime "All Metal" Catalysts, and catalyst heating systems.

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4722 Fourteenth St., Detroit 8, Michigan

City Light Plant Smoke Problem To Columbus

Worst offender of the smoke control ordinance in the city of Columbus, Ohio is the city's own Municipal Light Plant, declares Smoke Control Supt. Richard D. Schafer. Furthermore, he says that officials of the city department of electricity steadfastly refuse to do anything about it.

In the newspaper interview Schafer said that the city department had asked for help in solving the problem, and that men from Battelle Memorial Institute and from industry made studies and offered plans on smoke control, but that the officials refused to take action on them.

It's embarrassing, says Schafer, to tell a businessman he must do something about the smoke rising from his plant when the businessman can look out a window and see the dense smoke rolling up from the light plant. Schafer thinks maybe one answer to getting action might be a lawsuit brought by a taxpayer.

'You'll Go Indoors for Fresh Air' Says Norris

"The time is coming when you are going to go indoors for a breath of fresh air instead of going outdoors for it," John W. Norris, president of Lennox Industries, Inc. told a users' forum on residential air conditioning in New York City recently.

The air conditioning and heating equipment manufacturer predicted that "within a year or two the industry will be able to offer simple electric means of decontaminating the polluted air that abounds in American cities today."

He envisioned its use in the home in some sort of air circulating system that would bring in outside air from one central point, clean it, and then circulate it to all rooms.

Attending the forum were 17 housewives from suburban New York City, all users of Lennox air conditioning systems. They told him what they particularly liked about air conditioning — restful sleep, indoor barbecuing, less cleaning, relief from allergies — and what they didn't like—inadequate cooling under heavy load conditions, noisy compressor, and register locations.

Lockport, N.Y. Seeks To Bar Chemicals Maker

The city of Lockport, N. Y. is seeking a permanent "cease and desist" injunction against Niagara Materials, Inc. and Niagara Abrasive Co., Inc., the former a producer of chemicals, the latter firm having leased buildings to the chemicals producer.

It's the contention of the city that the chemicals firm violated several sections of a 1948 zoning ordinance and is manufacturing materials that are "obnoxious by reason of odor, dust, smoke, and gas." It is contended that zoning laws have not been complied with in that buildings used were not constructed for the production of chemicals.

Meetings

American Society of Mechanical Engineers, *Chase-Park Plaza hotels, St. Louis, June 14-18.*

Electrical Precipitation Seminar, *Pennsylvania State University, University Park, Pa., June 14-19.*

U. S. Public Health Service course in advanced training for sanitary engineering reserve officers: community air pollution, *Robert A. Taft Sanitary Engineering Center, Cincinnati, June 15-26.*

National Society of Professional Engineers 1959 Engineering Progress Exposition, *Hotel Commodore, New York City, June 17-20.*

Air Pollution Control Association 52nd annual meeting, *Statler hotel, Los Angeles, June 21-26.*

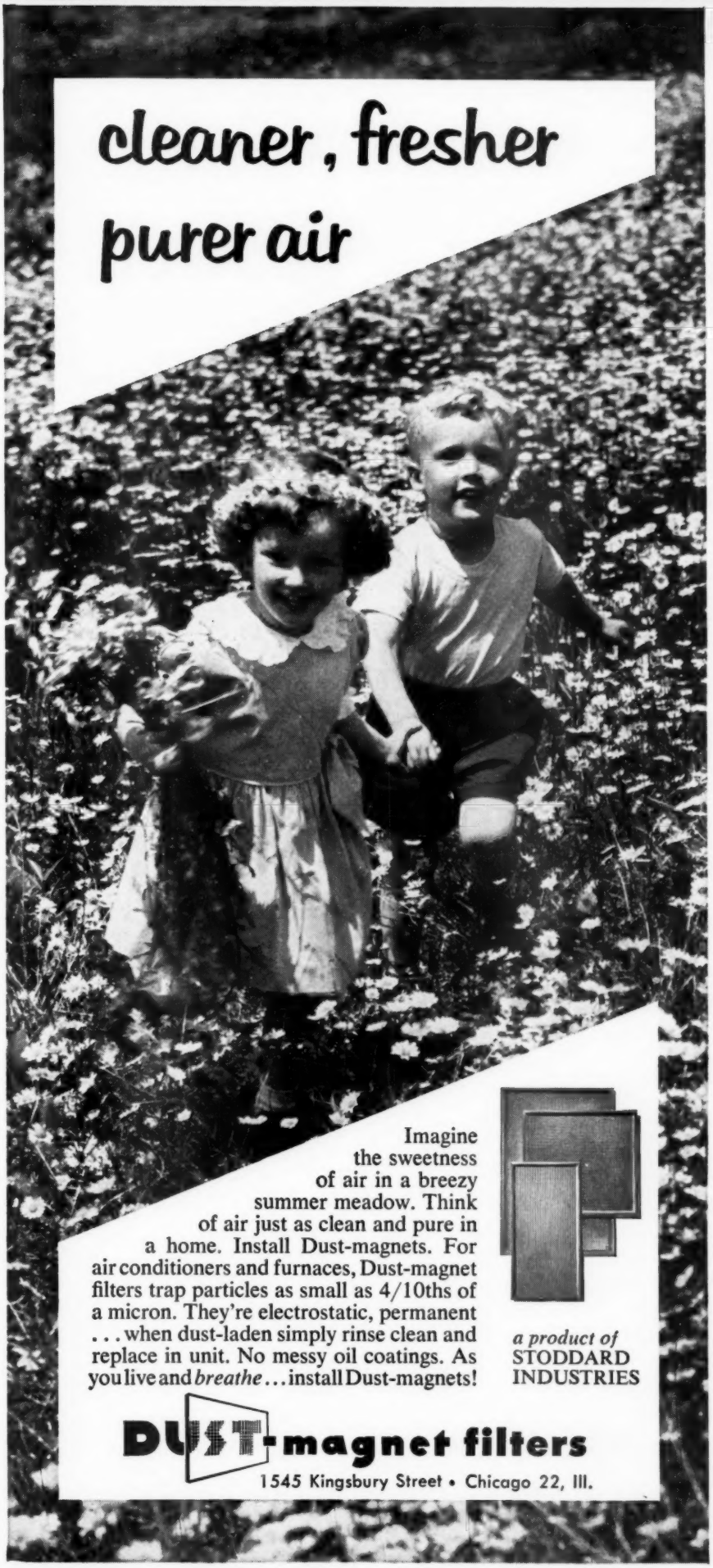
American Society of Heating, Refrigeration, and Air Conditioning Engineers annual meeting, *Lake Placid Club, Lake Placid, N. Y., June 22-24.*

Central States Sewage & Industrial Wastes Association, *Pick Nicollet hotel, Minneapolis, June 24-26.*

Instrument Society of America 14th annual Instrument-Automation conference and exhibit, *International Amphitheatre, Chicago, Sept. 21-25.*

U. S. Public Health Service training course in community air pollution, *Robert A. Taft Sanitary Engineering Center, Cincinnati, Sept. 21-Oct. 2.*

Air Conditioning and Refrigeration Institute 11th Exposition of the Air Conditioning and Refrigeration Industry, *Atlantic City, N. J., Nov. 2-5.*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Imagine the sweetness of air in a breezy summer meadow. Think of air just as clean and pure in a home. Install Dust-magnets. For air conditioners and furnaces, Dust-magnet filters trap particles as small as 4/10ths of a micron. They're electrostatic, permanent . . . when dust-laden simply rinse clean and replace in unit. No messy oil coatings. As you live and *breathe* . . . install Dust-magnets!
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New PRODUCTS

Gas Detector Kit

Gas detector provides accurate measurement of concentrations of toxic gases or vapors in atmosphere through a colorimetric chemical reagent that produces a color stain varying in length or intensity with the air concentration of the gas.

Kitagawa Unico model 400 detector kit consists of hand pump and detector tubes which measure concentrations of specific gases and vapors.

Same pump and operating procedures are used for all determinations.

Each detector tube contains reagent which absorbs and reacts with gas being measured. At 68 F, average percent error of tubes is less than 5 percent.

Source: *Union Industrial Equipment Corp., Dept. AE, 40 Beech St., Port Chester, N. Y.*

'Fiber-Aire' Ventilators

Full line of belt drive Fiberglas roof ventilators provide capacities from 1,800 to 13,500 cfm. Bonded Fiberglas housings are virtually indestructible. They withstand severe impact, weather, temperature, and most chemicals. "Fiber-Aire" housings absorb noise and vibration.

They do not act as a sounding chamber. Stainless steel air flow guides eliminate internal air shocks.

Source: *The Swartwout Co., Dept. AE, 18511 Euclid Ave., Cleveland 12.*

Eye-Bath Bottle

Eye-bath bottle operating on pneumatic principle, is claimed to be equally effective and safe in rinsing for both slight and severe chemical burns.

It is easy to clean, is unbreakable, and can be used in any position.

Source: *Advance Glove Mfg. Co., Dept. AE, 901 W. Lafayette Blvd., Detroit 26.*

87-Ton Condensing Unit

Drayer-Hanson air cooled condensing units are now available up to 87 nominal tons in a single unit. Largest previous single unit capacity was 25 tons.

Self-contained, remote type units are available for ceiling or wall suspension, indoors or outdoors. Operating on draw-through principle, the unit blasts discharge air upward, carrying most of sound with it.

Low profile unit has totally enclosed, fan cooled motors and oversize access door.

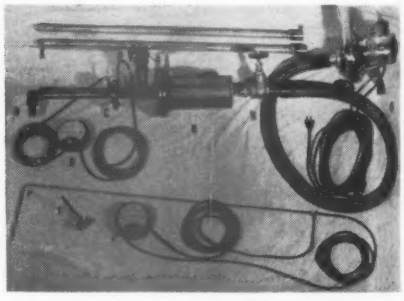
Source: *Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. AE, 3301 Medford St., Los Angeles 63.*

Use Communications Center, page 35, for requesting more information about articles, advertised products, literature, etc.

Dust Sampling Unit

New portable Dust Sampling Unit TE-102 measures dust or fly ash loading of boiler flue gas and can determine solids content of any gas stream even at high temperature or in corrosive gases.

TE-102 is a self-contained sampling unit with filtering section attached directly to the sampling tube and a separate blower. Sampling nozzles and extension tubes are made with quick locking connections.



Unit is fabricated of stainless steel to withstand high temperatures or corrosive gases and prevent contamination of sample with rust and scale.

Sampling unit consists of a sampling nozzle(N) flow tube (K), orifice meter (C) and filter case (U) in one campact unit. The exhauster unit (A) is a high pressure centrifugal blower with universal motor.

Source: *Breslove Separator Co., Dept. AE, Commonwealth Bldg., Pittsburgh 22.*

Micretain Filter

New line of filters with an efficiency of 95 percent on 0.3 micron particles and of 99 percent by the discoloration test using atmospheric dust, has been announced.

Known as the "Micretain" series "Absolute" filter, it offers extremely high efficiency at an initial pressure drop of only 0.4 in. wg. Tests to a final pressure drop of 1.0 in. wg using 100 percent outside air show a service life of at least 4,000

hours without the use of prefilters.

The filter medium is encased in a self-supporting chipboard frame. New glass-asbestos filter medium with Kraft separators provides a capacity of 1000 cfm in a face area of 24 in. by 24 in. and a filter depth of 11½ in.

In hospital operating room supply systems, with only 0.4 in. initial pressure drop, the Micretain filter is 97 percent efficient in removing nebulized staphylococcus aerosols and essentially 100 percent efficient in removing bacteria attached to dust particles.

Micretain filters are available in special material for high temperature, high humidity, and fire and corrosion resistance.

Source: *Cambridge Filter Corp., Dept. AE, 738 E. Erie Blvd., Syracuse 1, N. Y.*

Volt Amp Tester In Safety Yellow

To conform with standard safety practices, Amprobe Junior volt-amp tester is now made in safety yellow.

Amprobe Junior is available in 25, 50, and 100 amps full scale in either 125/250 or 150/600 volts. Accuracy of both voltage and current readings is plus or minus 3 percent of full scale. Readings are obtained on 1.8 in. calibrated scale.

Source: *Amprobe Div., Pyramid Instrument Corp., Dept. AE, 630 Merrick Road, Lynbrook, N. Y.*

Power Roof Ventilator

Ventilating capacity in the Ilg line of Type L-CRF airfoil centrifugal power roof ventilators has been increased from 6,970 to 11,000 cfm with the addition of three new models. The units are specially designed for high-capacity duct and flue exhaust applications.

The new Ilg units have a weather-tight housing of heavy-gauge spun steel. Roof is aluminum. Airfoil-type fan has direct drive permanently lubricated motor, specially designed for ventilator use. Patented, pressure-type self-cooling of motor and motor compartment protects motor from heat from sun and hot exhaust air.

Source: *Ilg Electric Ventilating Co., Dept. AE, 2850 N. Pulaski Road, Chicago 41.*

Block and Vent Valve

Miniature ¼ in. block and vent valve has been especially designed for control air service utilizing one operator.

Air flow is straight through at operator pressures of 5.5 psi or greater. As the operator pressure drops to 3.5 psi, air service is blocked, and when it reaches 2 psi or less, the cavity between the blocked ports vents to atmosphere.

The body pressure rating is 30 psi and the body temperature rating is for ambient air only.

Source: *George W. Dahl Co., Inc., Dept. AE, 86 Tupelo St., Bristol, R. I.*

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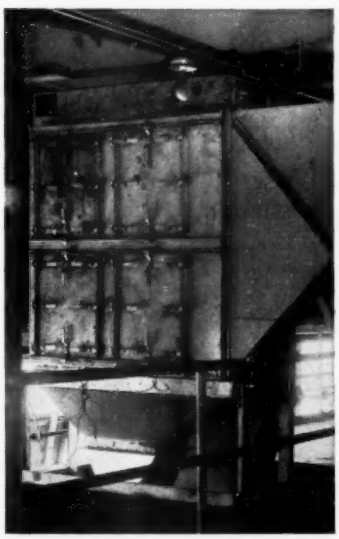
NIAGARA MOHAWK POWER CORP.* prevents GAS AND COAL DUST ACCUMULATION with



DUSTEX COLLECTORS

Engineers of Niagara Mohawk Power Corp., Buffalo, N.Y., prevented an accumulation of explosive gas and dust at its Huntley Steam-Electric Station — with two Dustex Miniature Cyclone Collectors ventilating bunkers and hooded belt transfer points. Results — gas removed — fines salvaged and returned to bunker continuously. No visible discharge from stacks! Maintenance — none to date, thanks to Dustex high-efficiency, non-plugging design which employs no filters, and Dustex Vacuum Valves which have no moving parts.

SEE FOR YOURSELF the efficient performance of Dustex on your job, at no obligation. Write today for Dustex Bulletin "A Simplified Determination Test."

*Contractors: STONE AND WEBSTER ENGINEERING CORP.

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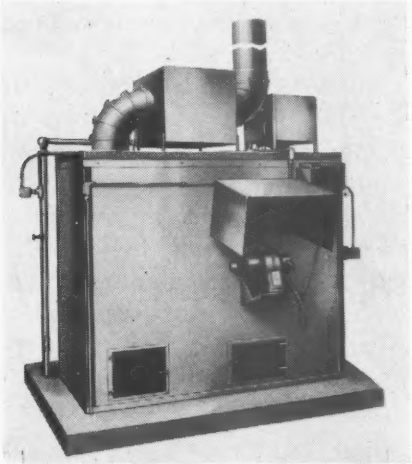
(Continued from preceding page)

Incinerator Meets Codes

New incinerator, designed and built by Winnen Incinerator Co., is said to reduce smoke, odor, and fly ash to such infinitesimal amounts that it meets strictest air pollution codes.



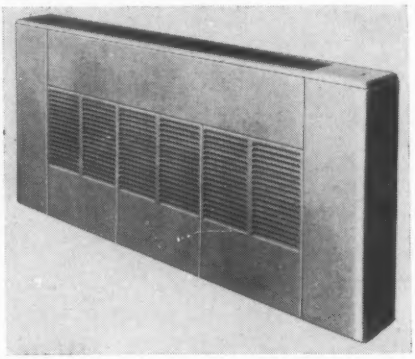
In addition to multiple burners and combustion chamber, it has automatic lock on feed door and water wash. Feed door cannot be opened until temperature in secondary combustion chamber reaches pre-set heat for maximum operating efficiency. Water wash captures any remaining fly ash and reduces smoke.

Special blower provides up draft through water wash, greatly reducing chimney requirements.

Source: *Winnen Incinerator Co., Dept. AE, 932 Broadway, Bedford 89, Ohio.*

Inductor Air Conditioners

Improved line of American Blower low pressure inductor air conditioners for application to perimeter areas of multi-room buildings using conventional ductwork now includes units with secondary coils 20, 28, 36, 48, or 60 in. long. Up to 700 cfm of fresh air can be supplied by each unit.



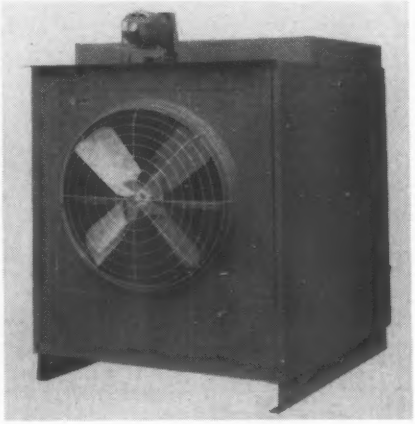
Unit volume of primary air is fixed with standard indexing and locking device which can be field set or manually operated through remote control arrangement. Secondary coil can be controlled manually by a hand valve from standard access door.

Coils are available with four, five, and six tubes in face, single row, in hot water and steam construction. Coils have ½-in. copper tubing with aluminum fins pressure bonded to the tubes.

Source: *American-Standard Industrial Div., Dept. AE, Detroit 32, Mich.*

Mason Cooling Towers

New line of packaged induced draft water cooling towers is designed to provide more cooling capacity in less space.



Series 3200 "Hydra-Glide" cooling towers are either all steel construction with plastic base coating or stainless steel. All have heart-grade redwood filling, stainless steel fan shaft, and venturi-type fan throat.

Model 3208, which has 7.5 ton capacity at 78 F wet bulb temperature, is 30 in. wide, 45 in. long, and 54 in. high. Towers range from 5 to 60 tons capacity. They are assembled with slip-fit type joints so they can be easily disassembled for movement through cramped space and then reassembled.

Source: *Mason Products, Inc., Dept. AE, 9 Crane Court, Woburn, Mass.*

Flow Tube Line Expanded

Insert-type "Builders-Providence Dall" flow tubes for primary flow metering can now handle line sizes from 4 in. up to and including 48 in.

Designed for installation between pipe flanges, tubes are used wherever gases, acids, alkalies, and slurries make accurate metering necessary.

Tube is made of fiberglas-reinforced epoxy or polyester resins with metallic throat lining. Design features included self-contained instrument taps, low head loss, low weight, accuracy within 1 percent of actual flow rate, maximum corrosion resistance, as well as lower cost.

Source: *B-I-F Industries, Inc., Dept. AE, 345 Harris Ave., Providence 1, R. I.*

(Please turn to page 46)

Use Communications Center, page 35, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

Lateral Approach To Tank Ventilation

by G. E. Wallin

Wallin Engineering Sales Co.

Chicago, Ill.

Do you have a fume collection problem? Hoods don't "pull" properly? Here's help in the form of simplified methods for accurate design of hoods for open tank ventilation. Included is data on sizing of exhaust fans.

AN OPEN TANK, FULL OF FUMING SOLUTION, on a floor amidst plant operating personnel, poses a real problem, especially if the solution is toxic or corrosive. Solution can take three forms . . . the tank can go . . . the people can go . . . or both can stay and the fumes can go.

If you decide on the latter, here are a few suggestions for health and comfort. First of all it must be recognized that vapors and fumes will continue to leave the solution surface whether the tank is in active use or not, and that they must be captured and removed at the source to prevent diffusion and contamination of all the air in the building. The means of removal is usually a specially shaped exhaust opening placed as near the source of fumes as possible; frequently a very complex design process. This article will provide data on hood design methods and fume removal processes.

Determine Solution Temperature

First step is to determine the maximum temperature of the solution surface and its quality (toxic or corrosive); the width and length of the net surface, omitting any area overhung by the exhaust manifold or other covering; and decide what type of manifold you will use. The manifold should be installed preferably at the longer side of the tank, but if necessary, may be placed along the shorter side. Whichever way, manifold length is considered as "L" and the other side "W", even when "W" is greater than "L".

Control of fumes and vapors from an open tank is a matter of proper control velocity for the temperature and quality of the solution in the tank. Adequate control requires the reduction of contamination below the "maximum allowable concentration" (MAC), usually in a published list of materials;* and it also

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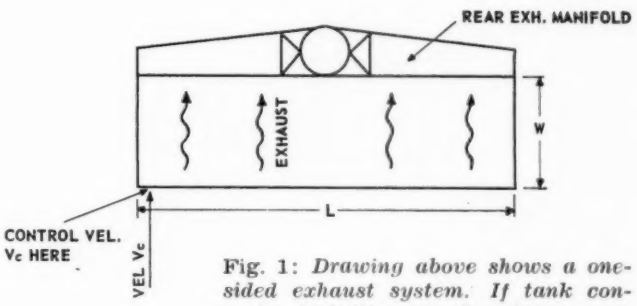


Fig. 1: *Drawing above shows a one-sided exhaust system. If tank contents are boiling, overhanging canopy or "push-pull" hood is used.*

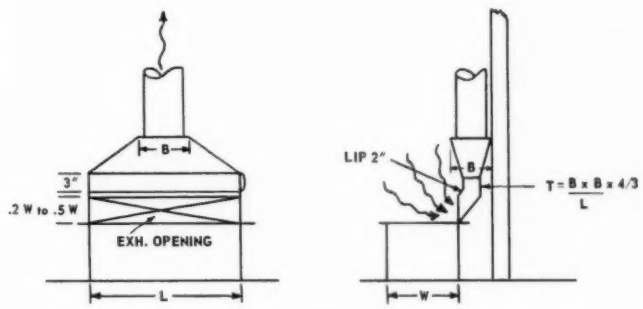


Fig. 2: *Use following formula for calculating exhaust for hood shown above: Ao = 36 x Q/1000 x $\sqrt{T/fan\ s.p.}$ For complete data, see text on following page.*

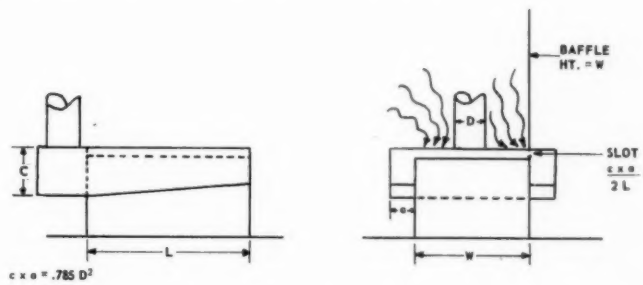


Fig. 3: *Baffled exhaust system. Data for sizing allows for shock loss in collecting chamber at end of tank and at entrance to main exhaust duct.*

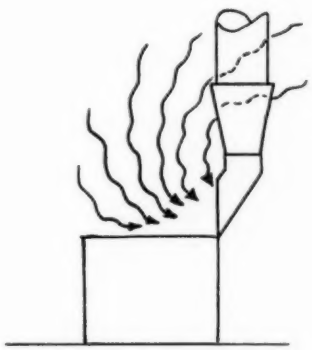


Fig. 4: *When desiging exhaust system as shown above, use same formula as hood shown in Fig. 2.*

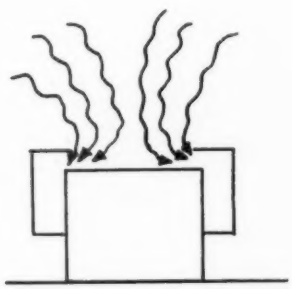


Fig. 5: *Two-sided exhaust system is highly efficient if designed accurately.*

(Continued from preceding page)

means the prevention of visible vapor losses from hot tanks, even when the vapors are non-toxic. *Control velocity* is the air flow velocity across the most remote fuming surface relative to the exhaust opening, which provides adequate control of the fumes or vapors. With an exhaust manifold on one side of a tank, for instance, the most remote point would be the opposite edge.

A control velocity of 100 fpm (feet per minute) applies to Table 1 below, and you will notice that the exhaust rate in cfm per square foot of surface varies with "W"/"L"; it also varies with the method of exhaust.

Table 1—Rate of Exhaust, cfm per Square Foot Surface

Method of Exhaust	*Ratio W/L*			
	0-.25	*.26-.50*	*.51-.75*	*.76-1.0*
1 - Sided Baffled	126	155	175	190
2 - Sided Baffled	126	150	166	178
1 - Sided No baffle	185	206	220	230
2 - Sided No baffle	170	187	199	208

The term "Baffle" in the table refers to some means of forcing air to flow across the tank to the exhaust manifold rather than from behind the tank. A tank backed against a wall, for instance, is baffled; and a plate standing as high as the tank is wide provides an effective baffle.

As stated before, the exhaust rates shown in Table 1 provide a control velocity of 100 fpm. But this control velocity, in turn, must be modified for solution temperature and also for solution quality. For relatively non-toxic and non-corrosive solutions, the tabulated rates should be used for temperatures of 180 F, or less; and for 125 F, solution temperature use 75 percent of the tabulated rates; but for temperatures over 180 F and up to 200 F, use 1.5 times the tabulated rates of exhaust.

Exhaust Rates Vary

For example, suppose you have an 8 ft. x 2 ft. water rinse tank and expect to exhaust along the 8 ft. side. The value of "W"/"L" is .25 which requires, from Table 1, an exhaust rate per sq. ft. of water surface of 126 cfm, 185 cfm, or 170 cfm, to obtain a control velocity of 100 fpm, depending on how the air is exhausted. You will notice that 185 cfm is required if a single exhaust manifold is used along the 8 ft. side and without a baffle, but only 126 cfm/sq. ft. if a baffle is used with either one-sided exhaust or two-sided exhaust.

**Industrial Ventilation.* Available from Committee on Industrial Ventilation, P. O. Box 453, Lansing, Michigan. $4.00.

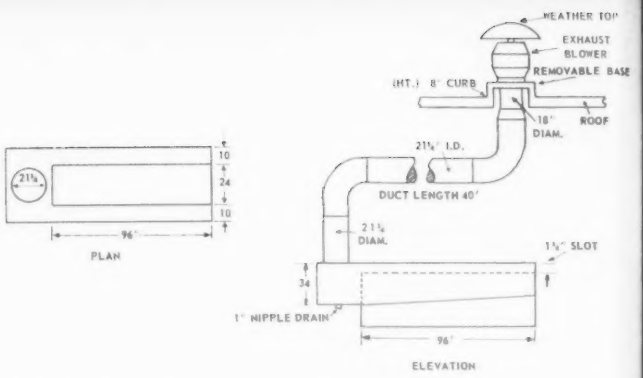


Fig. 6: *Details of typical exhaust system problem, where dimensions are given and exhaust blower must be selected. Solution is detailed in text on page 21.*

With one-sided exhaust as shown in Fig. 1 where the tank is against a building wall, we will use 126 cfm x 8 ft. x 2 ft. or 2020 cfm if the tank is a hot rinse at 180 F, or 3030 cfm if it is maintained at 200 F. If the tank is simply for warm rinsing at 125 F, or less, you should use .75 x 2020 or 1515 cfm total exhaust. If the tank contents are actively boiling, an overhanging canopy or "push-pull" hood arrangement should be used.

"Push-Pull" System Design

Supply and exhaust rates for a push-pull system, however, do not depend on the same criteria as conventional exhaust; proper design requires detailed handling and considerable engineering skill.

Completely adequate design for conventional lateral exhaust systems also require considerable engineering skill, but it is possible that rough calculations can produce a design which will work passably well. As an example, the following formulae may be used for design of the type of exhaust shown in Figures 2 and 4:

$$\text{Manifold pressure loss} = 0.5\ Hv$$

$$\text{Trial duct loss} = \frac{4 \times L}{3\sqrt{Q}}\ Hv$$

$$\text{90° elbow @ 0.6 Hv each} = \text{No.} \times 0.6\ Hv$$

$$\text{Weather top loss} = 0.5\ Hv$$

$$\text{Sum} = \text{Total } Hv$$

where Hv = *Velocity pressure in inches water in duct connected to manifold*

L = *length of above duct in feet*

Q = *total cfm to be exhausted from tank*

T = *numerical total of velocity heads*

then,

$$Ao = 36 \times Q/1000 \times \sqrt{T / \text{fan s.p.}},$$

where s.p. is static pressure, in inches water as shown

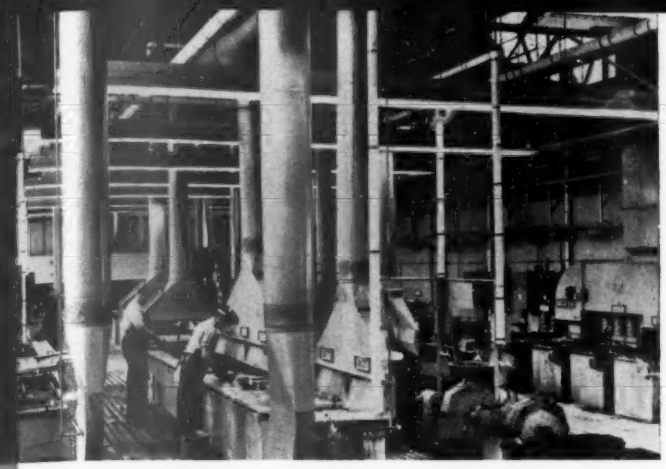


Fig. 7: *Fumes are removed right above surface of liquid with "push-pull" system of tank ventilation.* Photo courtesy General Electric Co.

in fan catalog ratings. If round ducts are to be used, "D," in inches diameter, $= 1.13 \times \sqrt{Ao}$

For manifold exhaust shown in Fig. 3 or 5, determine "T" as above, but use 2.3 Hv for manifold loss instead of .5 Hv. That value also allows for shock loss in a collecting chamber at the end of the tank entrance to the main exhaust duct. Then:

$$Ao = 36 \times Q/1000 \sqrt{T / \text{fan s.p.}}$$

where "Ao" is area in square inches of main exhaust duct. Although tapered slotted manifolds designed by the author are constructed entirely differently from the following design formula, the following simple construction will perform as well as the usual slotted duct. Thus, for each of the tapered ducts for 2-sided exhaust, make duct area at large end where it enters the collection box equal in area to "Ao." Then make each of the exhaust slots with area equal to ½ x "Ao." The length of the slot will be "L" inches and the height of slot Ao/2L with "Ao" in square inches. Slope the bottom of tapered duct enough to provide drainage of moisture.

Exhaust Fan Selection

A compact and efficient exhaust fan is very important, of course, after all this trouble about design. For the average installation, after determining the required capacity of the fan in connection with the method of exhaust, you may select a fan at ⅜ in. to ¾ in. s.p. for rear exhaust manifolds shown in Figure 2 or 4; but select a fan at ¾ in. to 1¼ in. s.p. for Figure 3 or 5.

Example

Required: To control fumes and vapor from an 8 ft. x 2 ft. sulphuric acid pickling tank maintained at 180 F., and using 2-sided exhaust without baffle.

Data: Length of duct from tank to point of discharge to atmosphere, 40 ft. plus two 90° elbows and with duct covered by weather top.

(Please turn to page 52)

Fig. 8: *Roof ventilators provide both air intake and exhaust for "push-pull" system of tank ventilation.* Photo courtesy General Electric Co.

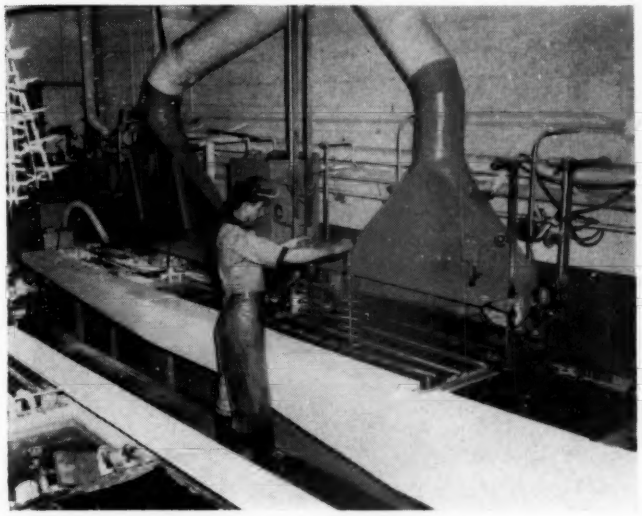


Fig. 9: *Fume removal system from plating tanks at Woodward Governor Company plant, Rockford, Illinois.*

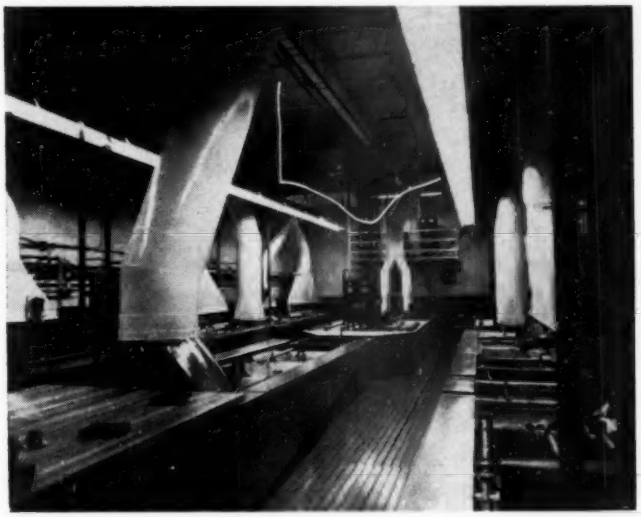


Fig. 10: *Lateral exhaust system fume removal at Woodward Governor Company. Fumes from this system are exhausted to atmosphere.*

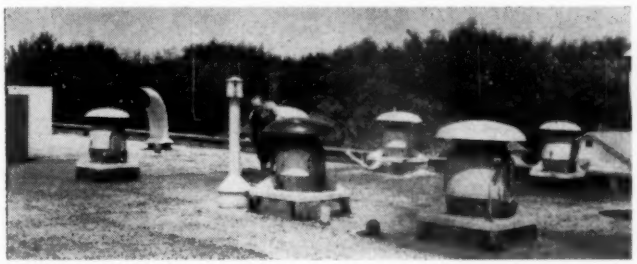


Fig. 11: *Bifurcator roof ventilators at Woodward Governor Company. Ventilators remove fumes from plating tanks.*

How Chevrolet Heats and Cools World's Largest Grey Iron Foundry

by E. A. Sloane

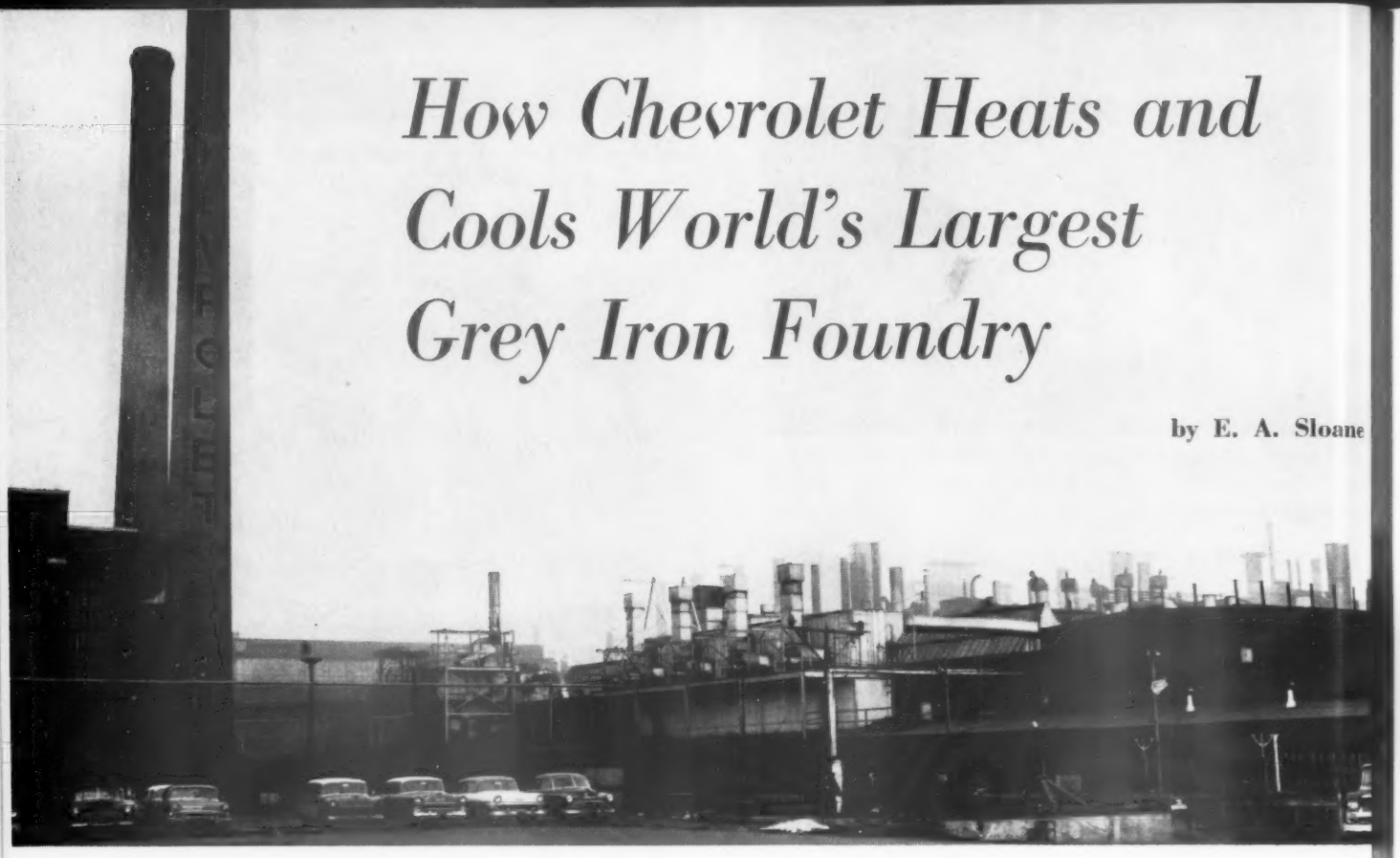


Fig. 1: *This mammoth foundry, where grey iron castings for Chevrolets are made, contributes remarkably little particulate matter to the air in Saginaw, Michigan. Efficient dust collection stops particulates at the source.*

Here's how Chevrolet ventilation engineers handle fume and dust removal, slag quench ventilation, make up air. Electric melting furnace, core cleaning, shakeout lift table, pouring, sand handling are among operations covered in this article.

THE 50 YEARS OF ACCUMULATED EXPERIENCE in ventilation and dust collection of one of the world's largest grey iron foundries offers many pointers for plant engineers and ventilation engineers concerned with industrial ventilation.

The Chevrolet Grey Iron Foundry (Fig. 1) at Saginaw, Michigan is said to be one of the largest of its type. Built in 1919 and enlarged over the years to its present size, it produces grey iron castings used by Chevrolet.

Many of the following fumes and dust removal and make-up ventilating air systems have been proved out over the years on a pilot basis, before general application in the plant.

An unusual exhaust system is used on an electric melting furnace. During charging and pouring operations it is necessary to have continuous exhaust to remove fine iron dust and carbon, iron oxides, CO and CO_2. The problem is one of providing duct connections to the hood over the pouring spout when the oven is tilted to permit molten metal to be poured into the ladle. The hood must tilt with the furnace. The problem was solved by using telescoping elbows and hood connections. Two 45° elbows slip into each other, and the hood connection slips into the hood. Details of hood and elbow connections are shown in the drawing in Fig. 2.

The hood has a face velocity of 200 fpm and exhausts 20,000 cfm at 2½ sp, at a temperature rise of 125 F from the 2500 F molten metal. Contaminated air is vented into a bag type dust collector.

The barrel core cleaning operation is one of general ventilation rather than one of dust or fume collection. The need here is for tempered air right at the operation. The air must be at the proper temperature both to compensate, winter and summer, for the heat gain to workers from a nearby core baking oven, and from residual heat in the cores themselves as they leave the oven and arrive at the cleaning table.

In barrel core cleaning, operators blow loose sand off cores with an air hose, inspect cores and file and smooth rough edges. This means they must be in close proximity to the warm cores at all times.

As Fig. 3 shows, the barrel core cleaning ventila-

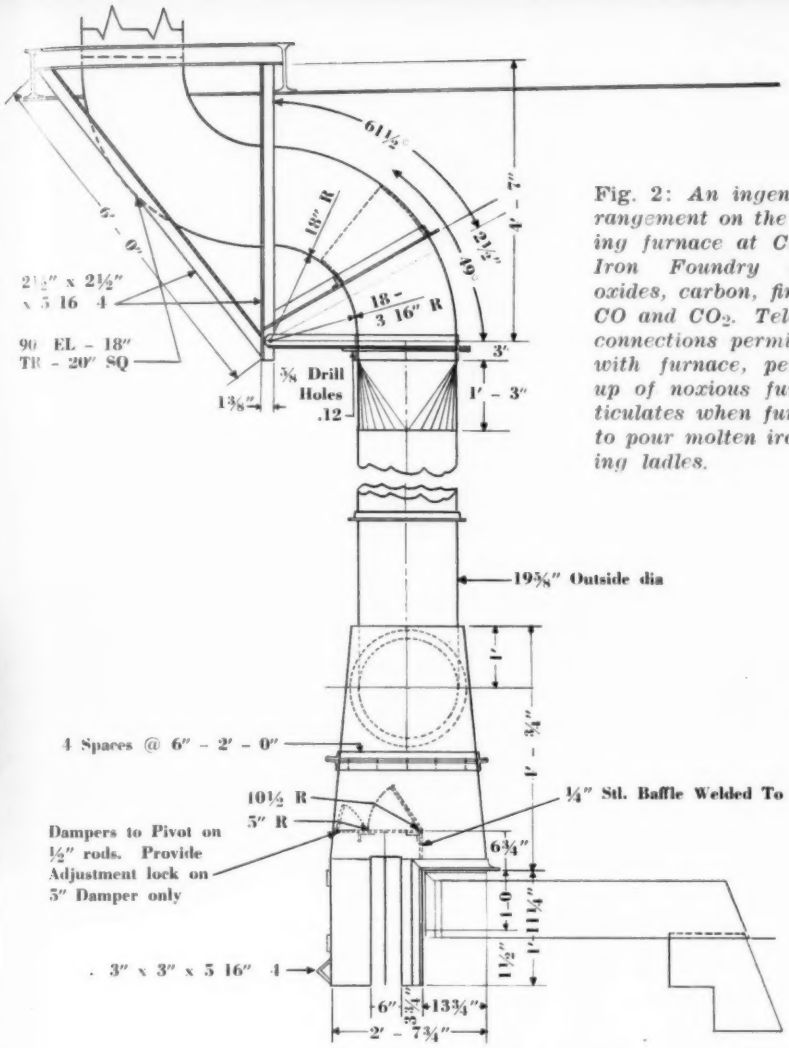
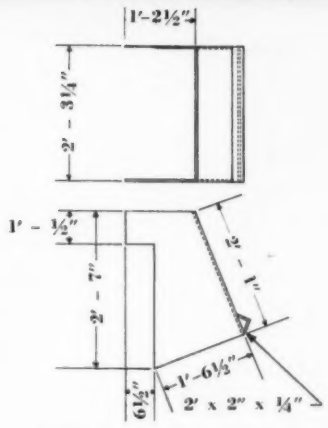
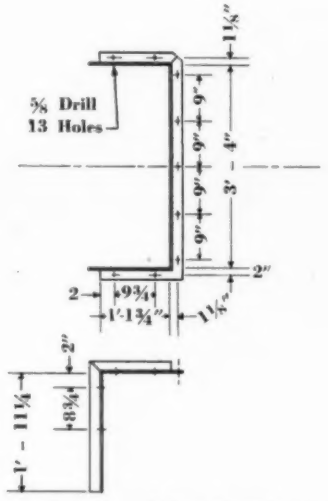


Fig. 2: An ingenious hood arrangement on the electric melting furnace at Chevrolet Grey Iron Foundry collects iron oxides, carbon, fine iron dusts, CO and CO_2. Telescoping hood connections permit hood to tilt with furnace, permitting pick up of noxious fumes and particulates when furnace is tilted to pour molten iron into traveling ladles.



Flange connection detail



Details of hood over pouring spout

tion problem was solved by bringing properly tempered air down to the working zone. The barrel core cleaning ventilation system capacity is 42,000 cfm, through a temperature rise of 85 F. Duct headers are 42 in. at fan discharge, split into branches through an extended plenum system. Air is discharged downward from adjustable outlets and outward through relief outlets. Air velocity is 3400 fpm in headers, and air leaves grilles at from 750 to 800 fpm. Outlet grilles are 30 in. by 6 in.

The 42 air outlets over the length of the extended plenum provided a blanket of cooling air over the working area, protecting against heat from the nearby core ovens and dissipating heat from the barrel cores.

At a typical shakeout lift table (Fig. 4), louvered side draft hoods, designed by Otto Brechtelsbauer, chief ventilation engineer, and his staff, provide ample capture velocity at the source yet leave sufficient room for operation. Face velocity near the louvers is 500 to 600 fpm; with system capacity at 22,000 cfm.

The V-8 core assembly operation is similar to the barrel core cleaning operation mentioned above. This assembly is close to core bake ovens and drying ovens. Problem is one of bringing tempered air to offset local heat gains. Make-up fresh air, heated in winter, is brought directly to adjustable directional outlets. Discharge velocity is 1800 fpm at a temperature between 70-75 F. Make-up air heating unit is a complete package, uses steam at 5 psi to heat 10,000 cfm of 100 percent outside air to diffusers. Adjustable outlets can discharge air from a straight down air flow to almost a flat pattern at discharge level.

Pouring of V-8 cylinder blocks posed the problem of heat dissipation from these heat sources as well as smoke from molds. General area ventilation would have required a prohibitive amount of outside heated air and permitted pollution of air within the plant. Compensating type hoods were installed close to block molds. In this type of hood about 50-60 percent of air exhausted is made up by a supply unit tied in directly with the exhaust hood and located so that supply air blows directly over the top of the molds.

Supply air entrains smoke and fumes from the molds and helps carry these pollutants into the exhaust hood. Capture velocity at the exhaust hood is 400 fpm.

Slag disposal was a real problem at Chevrolet.

(Please turn to following page)

Fig. 3: *Barrel core cleaning operation has problem of radiant heat gain from warm cores plus heat from nearby bake oven. Tempered air is brought down to working zone from overhead plenum, as shown above. Outlet velocity from grilles is from 750 to 800 fpm.*

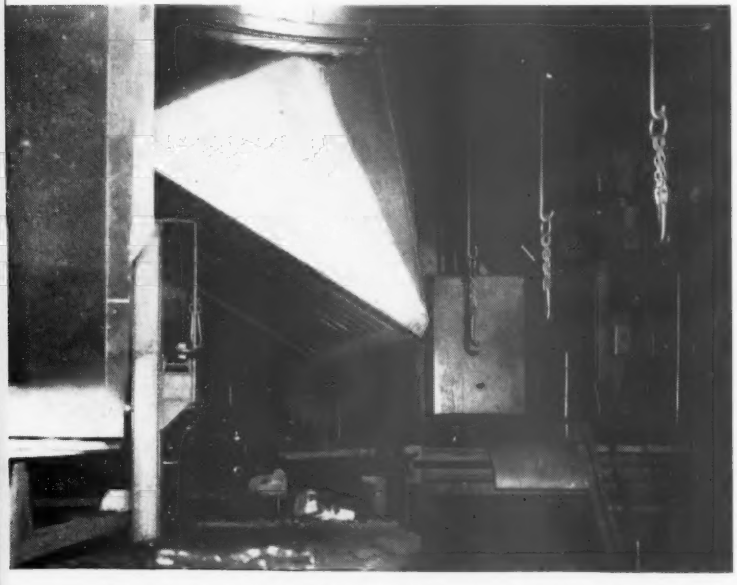


Fig. 4: *Louvered side draft hoods at this shakeout table provide ample capture velocity yet leave sufficient room for workmen. Louvers are adjustable for system balancing.*

Fig. 5: *Dust from foundry operations settles continuously on floors. This mechanical sweeper is one of a fleet of similar units that keeps dust off floors and thus improves quality of air inside the plant breathed by workers.*

(Continued from preceding page)

The hot quenched slag gives off highly corrosive steam that was tough to capture with ordinary exhaust hoods. At Chevrolet the entire slag disposal system is completely sealed off by a fully enclosed hood over the system. The hood is placed over a dewatering vibrator screen which is used to separate water from hot quenched slag. The system handles about 12,000 cfm at 3500 fpm duct velocity. A bleeder duct is fed into the main duct from the slag hood to reduce moisture content of steam-laden air and to prevent excessive corrosion of ductwork and fan wheel.

Fleet of Sweepers

Dust from shakeout, sand handling, core cleaning, and all of the other foundry operations at Chevrolet, is practically unavoidable, despite the many thousands of dollars spent to remove particulate matter at the source. While the Chevrolet Grey Iron Foundry represents the most modern ventilation practices, sand still collects on floors and if allowed to accumulate can pose an internal pollution problem as industrial lift trucks scoot around, as people walk through the plant, as air itself moves over people and processes. To keep floor dust at a minimum and thus to keep foundry air as clean as possible, a fleet of self-powered sweepers (Fig. 5) continually sweeps up floor dust.

Fume and smoke removal extends into the maintenance department, where fumes are removed from a metal cutting table (Fig. 6) by a hood that captures fumes under the table, permitting full access to working areas. Welders, as shown in Fig. 7, use an 8 in. flexible duct that can be positioned near the welding electrode. The 8 in. flexible duct has an exhaust velocity of 4000 fpm and removes 1400 cfm directly to atmosphere.

The engineering office, adjacent to the maintenance department and located in a foundry building, receives clean, filtered, conditioned air, keeping dust off drafting tables and desks. Air is filtered by a dry, washable filter ahead of an electrostatic air filter. The electrostatic air filter is cleaned every 4-5 months.

Make-up Air Filtered

At Chevrolet Grey Iron Foundry approximately 50 percent of the make-up air is filtered to prevent contaminant from re-entering the building. While collection equipment controls most of the particulate emission to atmosphere, such equipment is not 100 percent effective. Some dust, lint, flyash, etc. is always present in the outside air. Chevrolet ventilation engineers feel that contamination within an area cannot be less than the air being returned or supplied to that area. Further reductions in contamination of indoor air is possible only by providing air cleaning facilities to all make-up air.

Several types of filtering methods are used at Chevrolet Grey Iron. Both replaceable and washable

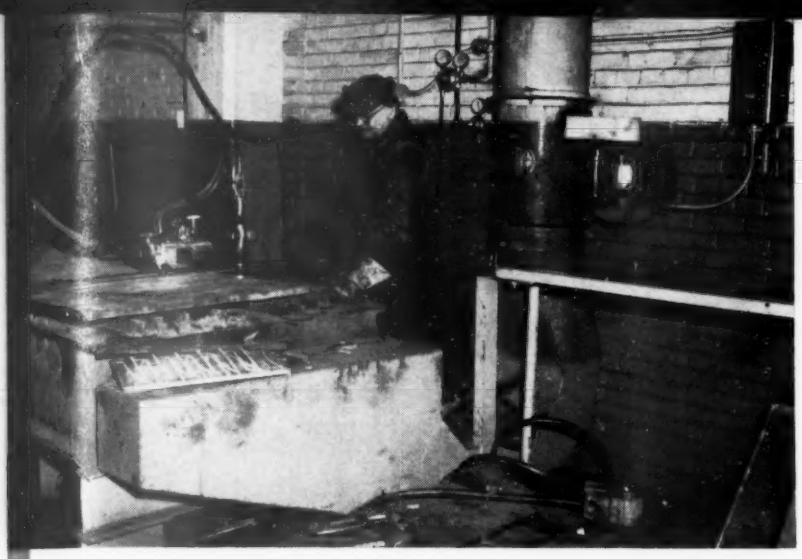


Fig. 6: *At this metal cutting table, fumes from flame cutting operation are removed by hood system placed under work table. This arrangement leaves plenty of working room for cutter operator and makes for efficient fume collection since hood intake can be located close to source of pollutant.*

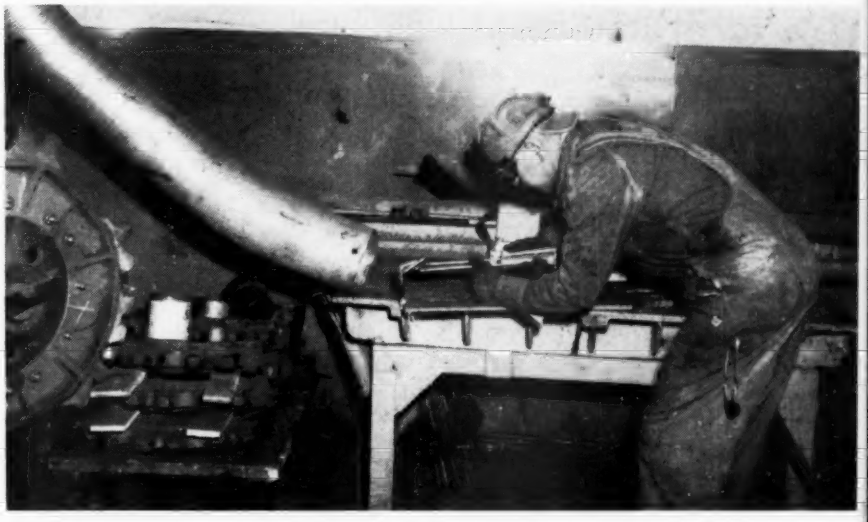


Fig. 7: *In maintenance shop, welders are protected from welding fumes by an 8 in. flexible duct that can be positioned next to welding electrode. This duct has an exhaust capacity of 4000 fpm.*

filters are used. Spray and cell type air washers are used. These air washers have the advantage of providing some evaporative cooling as well as filtering the air. The evaporative cooling effect provides a simple, low cost method of reducing outdoor air temperature for spot cooling of hot operations during the summer.

The cell type air washer, claims Chevrolet ventilation people, gives somewhat more effective cooling than the spray washer. Cell type air washers are not used where cupola flyash or iron dust prevails because these materials will not wash readily through cells of the washer. Instead the materials accumulate, harden into a mass and eventually block off air completely. For this reason one cell type washer at Chevrolet has been converted to a straight spray type unit, according to Otto Brechtelsbauer.

However, the best ventilation system in the world is no better than its maintenance, adjustment and final operation. At Chevrolet Grey Iron, maintenance personnel are trained to be completely familiar with all ventilation equipment, and are continually on the alert for necessary repairs or adjustments.

The ventilation department at Chevrolet Grey Iron makes every effort to spell out to production people the purpose and benefits of the ventilation system

(Please turn to page 49)

EQUIPMENT CREDITS

Compensating exhaust hoods: ***Claude B. Schneible Co.***

Capillary air washers: ***American-Standard Industrial Div.; Clarage Fan Co.***

Fans and blowers: ***Buffalo Forge Co.; Clarage Fan Co.; American-Standard Industrial Div.; Chicago Blower Co.; Sturtevant Div., Westinghouse; Joy Mfg. Co.; Aerovent Fan Co., Inc.; Hartzell Propeller Fan Co.; Propellair Div., Robbins & Meyers; Dryer Electric Co.; American Air Filter Co.***

Package make-up air units: ***Maxon Co.; North American Co.; The Trane Co.; American-Standard Industrial Div.***

Electrostatic air filter: ***American Air Filter Co.***

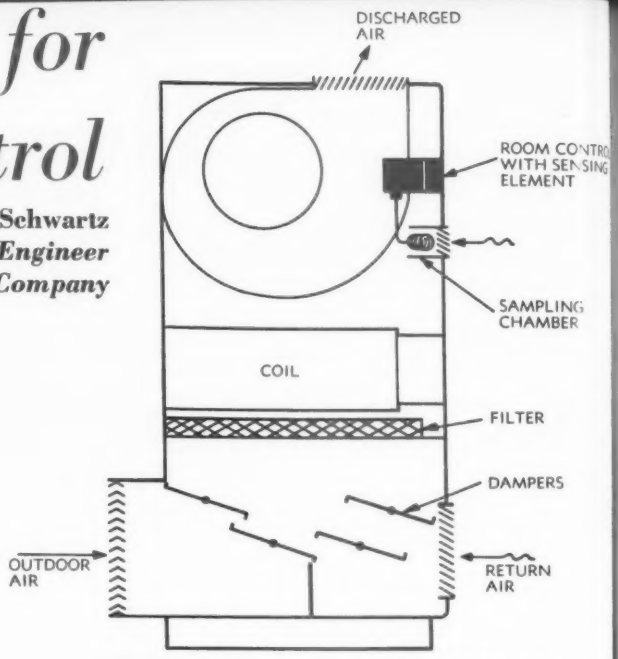
Bag type dust collectors: ***Pangborn Corp.; Wheelabrator Co.; W. W. Sly Mfg. Co. Co.; National Hydro-Filter Co.; Schmieg***

Wet type collectors: ***American Air Filter Co.; Claude B. Schneible Co.***

Techniques for Unit Ventilator Control

by **John Schwartz**
Field Engineer
Barber-Colman Company

Unit mounted thermostats versus wall mounted thermostats is the subject of this article on unit ventilator control systems. Response time, thermal lag, uniform temperatures, installation cost, maintenance, are among the factors discussed.



SKETCH OF TYPICAL UNIT VENTILATOR SHOWING THERMOSTAT AND SAMPLING CHAMBER

A CLASSROOM UNIT VENTILATOR may be defined as an assembly of blowers, heating elements, dampers and air filters contained in a compact and attractive enclosure. As a part of the unit ventilator assembly, apparatus must be provided to control the operation of its various components to maintain the desired conditions of temperature and ventilation within the classroom. The control apparatus directs or supervises operation of the unit ventilator so that it properly functions to heat, ventilate and cool the classroom according to a predetermined standard.

Within recent years prominent manufacturers of unit ventilator equipment have recognized the advantages of a refinement in temperature control equipment which permits the thermostatic temperature sensing element to be located within the unit ventilator enclosure. As unit ventilator manufacturers made provisions in their equipment for unit mounting of thermostats, sensing elements were developed so that the many advantages inherent in this type of control could be realized in practice. One of the obvious advantages of combining the thermostatic sensing element with the unit ventilator is the avoidance of wall mounted thermostats. The possibility of damage to the thermostat by accidental contact with objects being carried, or otherwise propelled, is eliminated. Opportunities for tampering with the thermostat are not present when it is enclosed in the unit ventilator; discomfort and increased operating cost through overheating caused by maladjustment are avoided, although proper adjustment by authorized persons is readily accomplished.

Unit ventilator mounted thermostats operate on the following principle. The sensing element is mounted in a small insulated chamber through which a representative sample of room air is forced by aspiration or some other means. The sampling chamber provided in modern unit ventilator equipment is scientifically located between 14 and 18 in. above the floor for optimum performance of the temperature control sensing element.

Changes in the heating or cooling requirements of the room quickly reach the control element because of the mechanically forced return of all recirculated air to the unit. Therefore, minor changes in room temperature are detected, and correction may be made by the unit ventilator equipment before the change becomes great enough to be noticed by persons in the room. In direct contrast, a wall mounted thermostat senses changes in room conditions only by its exposure to a small fraction of the total room air. Circulation of room air toward the wall thermostat takes place haphazardly at a low rate. Control operation lags behind actual need for temperature correction, often resulting in unstable variations in both room and unit discharge temperatures.

Faster Response

Faster response by the unit mounted thermostat is also achieved by virtue of its location in a moving air stream. The velocity of air motion over a wall mounted thermostat is low to the point of being imperceptible to human feelings. The technical explanation for faster response due to higher velocity air passing over the element involves the principle that the heat transfer rate between any fluid and a surface is a function of the velocity of the fluid passing over the surface.*

**Heating, Ventilating, Air Conditioning Guide Vol. 36, Page 175 ASHAE Inc. New York, 1958.*

Thermostatic elements located within the unit ventilator housing are free from the artificial influence sometimes exerted on wall thermostats by the very surface on which they are mounted. For example, consider the practice of reducing temperature during night and unoccupied periods, commonly employed in the interest of economical operation. After a period of 12 hours or so duration, building walls dissipate heat, and wall temperature approaches the value of the night thermostat setting. As operation is resumed at normal daytime temperature, the wall mounted thermostat is in close proximity to a large surface whose temperature may be 10° or more below the desired daytime control point.

Thermal Inertia

It is difficult to prevent the thermal inertia, or flywheel effect, of the wall mass from affecting control operation of the thermostat. Although the occupied space in the room reaches a comfortable temperature within an hour after operation at the day temperature is resumed, the walls may require several hours, often until after the middle of the day, before they reach room operating temperature. The artificial area of cold surrounding a thermostat mounted on a relatively cool wall will result in serious overheating of the room, with attendant discomfort, window opening, attempts at adjustment, inconvenience to operating personnel, and increased operating costs.

Troublesome chalk dust and other microparticles commonly present in classrooms may require costly maintenance to prevent erratic operation of wall type thermostats. Sensing elements properly designed for unit ventilator mounting avoid this expense, since only the element bulb is mounted in the airstream.

Uniform Temperature

Fast and accurate response of thermostats mounted in the unit ventilator cabinet combine to produce uniform room temperature at the desired optimum value for comfort of the classroom occupants and for economy of operation. Although some of the advantages that have been described cannot be obtained with wall mounted room thermostats, it must be recognized that satisfactory results have been achieved with this type of an instrument, provided an optimum wall location can be determined and

Above: ***How to hold even temperatures throughout the classroom despite cold drafts, radiant cold effect from windows, high heat gain from student occupancy, poses temperature control problem.***

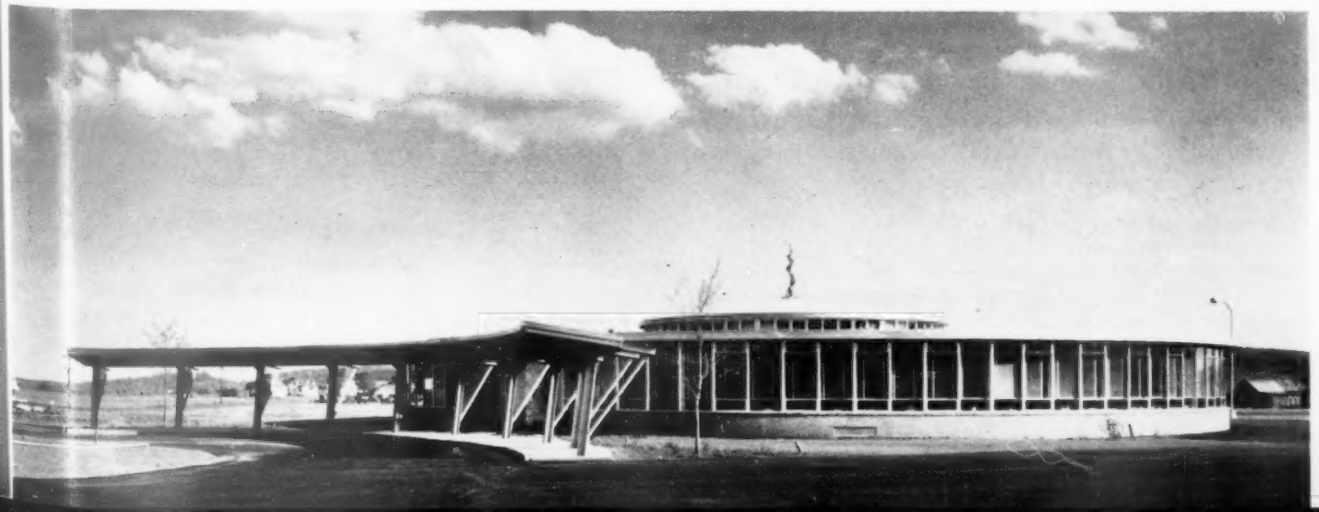
used for thermostat mounting. Too often, however, placement of the room thermostat at the optimum wall location may be sacrificed for consideration of architectural appearance, convenience of installation, or convenience of those who will make use of the classroom.

Easily appreciated are the inducements to locate a room thermostat adjacent to the lighting switches, since wiring, and possibly a pipe chase, will run to that point anyway. The switches may not necessarily be located at the optimum point for thermostat performance. Comparing wall location with unit ventilator location for a thermostatic sensing element, it may be said that while a wall mounted thermostat will perform well only if it is placed at the optimum location, the unit ventilator location is always representative, and will yield uniformly high quality results.

Not the least important advantage of the unit mounted location is the way it helps reduce installation costs by eliminating connections and pipe or conduit chases in floors or walls, between the room thermostat location and the unit ventilator. The cost

(Please turn to page 49)

Below: ***This Hereford Twp. (Pa.) elementary school, designed by architects Wolf & Hahn, makes lavish use of glass for lighting and design effects. Cold air downdraft off windows, inside rooms, is stopped by unit ventilators. Note unit ventilator openings in walls.***



by Robert H. Avery*
Director, Application Engineering
Cambridge Filter Corporation

The Meaning of "Clean Air"

PART III

Do you have a 'clean air' problem? This last of a three part series on dust-free 'white rooms' takes up actual design of the room itself and selection of physical equipment. Practical construction methods are outlined in the article. Work psychology is discussed.

In this last of a three part series on design criteria for dust-free "white rooms," actual design of the room itself is discussed in detail. The two previous articles in the April and May issues of Air Engineering covered dust particle size, air conditioning requirements and filter selection

Usually "white rooms" or critical assembly areas are built within an existing building. It is rare that the interior of any building has the construction characteristics necessary to allow any portion of it to be converted directly to a dust free area merely by pressurization. The information which follows can only outline general features, since there are many materials which give the desired characteristics. The proponent of each naturally feels that his particular material is the best.

Material Selection

All materials of construction should be selected for their non-flaking, non-powdering characteristics. Smooth glossy surfaces offer lower dust adherence, and as a result most of the material used in dust free rooms has either a chrome plate, stainless steel, glass, or plastic finish. Plastic should be used only where it will create no problems because of its possibility of being a static electricity generator.

One of the requirements of dust free room design is the elimination of ledges where possible. This is achieved by using windows only where necessary, and installing them in such a way that the window ledge is as small as possible. Doors should be flush type, with concealed hinges such as the Soss hinge used, if possible. Wall switches and the like should be eliminated.

Lighting fixtures, sprinklers and their piping are usually carriers on which dust tends to settle. To avoid the possibility of contamination from these sources, a translucent plastic ceiling can be used, with lighting fixtures and sprinklers installed above it. This plastic ceiling will help provide uniform illumination, and also prevent any dust from the lighting fixtures and sprinkler piping from falling on any of the operations. The plastic for the ceiling may also be selected so that it will soften and fall out of its frame at a temperature slightly below the sprinkler release point. As a result, if there is a fire, sprinklers can still be used effectively and the plastic ceiling will not interfere in any way.

The degree to which cleanliness is frequently

Fig. 1: *Central vacuum cleaning system makes it easy to keep after dust and dirt on floors, tables, miscellaneous surfaces. Convenient outlets to central system should be used.* Courtesy: Fafnir Bearing Co.

*About the author: ***Robert H. Avery has had over 12 years' experience in field application of dust collecting, heating and ventilating equipment. He was active for three years in the fields of industrial hygiene and public health, serving in this capacity with the Michigan Department of Health, St. Louis and Kansas. He holds AB and MS degrees in chemistry.***

Fig. 2: *Powered shoe brush can be used to remove dirt lodged between sole and the uppers.* **Courtesy: Fafnir Bearing Company.**

emphasized can be exemplified by the fact that in certain installations ball bearing butts are used as door hardware instead of the conventional butts, since the rubbing of metals in the old style could conceivably create flakes which could cause a contamination problem. Work benches are given special consideration, and are built at heights which eliminate the need for foot rests, and allow operators to keep their feet on the floor. Omission of the foot rest again prevents a possible source of contamination. Table pedestals are also designed for ease of cleaning and minimum areas for dust settling.

In addition to all of these precautions, a system of continuous vacuum cleaning may also be used. Conveniently located outlets to a central system avoid the possibility of recontamination which could occur with the bag type of vacuum cleaner. Some of the features mentioned previously are illustrated in Fig. 1.

Techniques to prevent contamination by the workers themselves involve two elements:

1. Clothing
2. Personal habits

Workers are usually required to wear clothing made of synthetic fiber fabrics proven to be lint free.

In order to assure this lint-free condition, clothing should be periodically checked for formation of loose fibers through wear. This clothing should be laundered with special care and rinsed thoroughly so that detergent or water softeners are removed and do not flake out of the clothing when worn later.

Head covering of some kind is a prerequisite to prevent hair or dandruff from causing contamination.

Shoes Present Dust Hazard

Shoes are probably the greatest potential source of contamination, and certain companies supply special work shoes free of charge. These shoes must be kept in the locker room at all times. Employees should change from street shoes to work shoes before reporting for duty. Where street shoes are allowed, employees are usually asked to cooperate by selecting materials which will not flake. Special boots made out of nylon or similar fabric are sometimes supplied to be worn over these shoes. Shoes themselves are usually cleaned off in a special brush as indicated in Fig. 2. These brushes succeed in removing all of the dirt that may be lodged between the sole and the uppers. In addition to this equipment, special mats with a tacky surface are used at the entrance to all

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Fig. 3: *Typically uniformed workers and washing procedures are shown in photo at right. Synthetic fabric clothing is worn for lint-free features. Head covering prevents hair particles from contaminating air.* Courtesy: Fafnir Bearing Company.

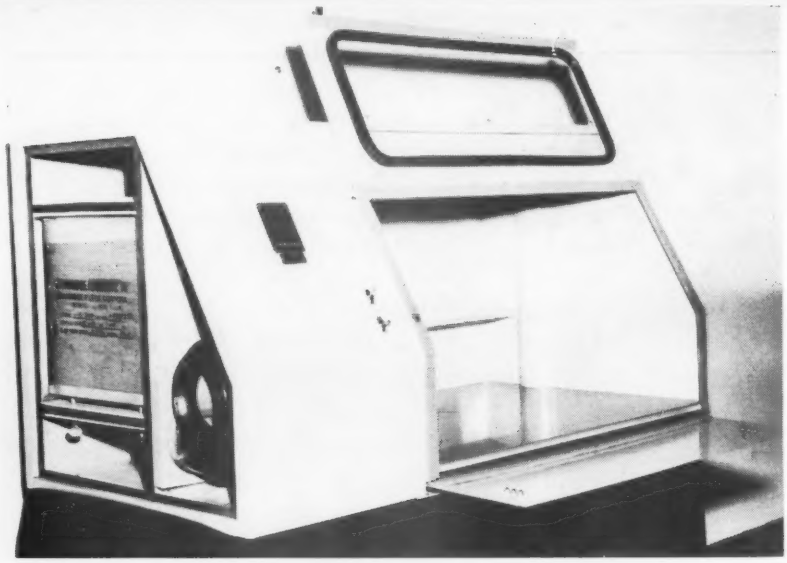

Fig. 4: *Special* Sterishield *assembly hood for final assembly of small parts. Hood is kept under positive pressure to keep out very few particles of dust which may have crept by air filtration system. Booths have own air supply.* Courtesy: Baker Co.

(Continued from preceding page)

the critical areas to collect any dust which may have accumulated on the soles of the shoes.

Cooperation from workers is one of the most important means of keeping a room dust free. This cooperation involves many facets, some of which are listed below.

1. All workers must assume a sense of responsibility and interest in their job, so each becomes personally concerned about keeping the area as clean as possible.
2. Workers must be willing to stay within the critical assembly area for the total of their working day, and to accept regulations regarding smoking, etc. which might not be as liberal as in other working areas.
3. Women especially must agree not to use makeup or powder which could cause dust.
4. All workers must be trained in a procedure similar to an operating room area, involving washup each and every time before entering a critical area. Because paper or cloth towels could be a source of lint, electric hand dryers are used very frequently. Liquid soap is used because some engineers feel that bar and powdered soap may leave a dusty residue on the hands.

Worker's Attitude Important

All in all, it should be recognized that the worker in a dust free area must have a better than average attitude toward his or her job, a willingness to assume personal inconveniences and a sincere interest in keeping an area dust free. Fig. 3 shows some typically uniformed workers, and washup procedure.

The most obvious precaution in the handling of finished materials is that they should not be touched by human hands. Oil from the skin and perspiration can radically affect many of the items assembled in these critical areas. For this reason, employees who must handle parts are required to wear gloves or finger cots which will not create any lint.

In addition to this, there are tools available designed specifically for handling parts such as bearings so that they need not be touched even by a gloved hand. Small components are frequently stored in stainless steel pans which can be covered, with only enough parts uncovered at any one particular time to take care of immediate assembly requirements. Storage cabinets for these stainless steel pans are frequently built-in so that their front is flush with the room wall.

Even in "white rooms" it is often a practice to carry on final assembly in special hoods, under positive pressure, to keep out even the very few particles of dust which might have penetrated all the previously outlined defenses. These booths have their own air supply consisting of a super-interception filter and blower system. Fig. 4 shows a STERILSHIELD* with the end removed to show the separate blower and the ABSOLUTE† filter used for air supply. A group of such hoods is shown in Fig. 5. During all normal operations the upper section with the glass panel is lowered and in place so that the operator cannot contaminate the product with dandruff, hair, or skin flakings. The lower section slides in below the work area, and is closed and locked in place only when the STERILSHIELD is not being used. This prevents dust from getting into the unit during non-operating periods. These hoods are supplied with their own source of illumination.

Hood Tests Show Efficiency

Tests performed at the request of the manufacturer of STERILSHIELDS illustrate the very low dust concentrations that can be secured by the use of these hoods with super-interception filters. Results of this test are shown in Table 1. The remarkable reduction in the number of particles in the 1.0-1.4 micron range is especially significant, and tests else-

**T.M. The Baker Company, Biddeford, Maine.*
†T.M. Cambridge Filter Corporation, Syracuse, New York

where would indicate that the reduction would continue even in particles smaller than one micron.

The methods of monitoring the dust concentration in a "white room" will depend, to a great deal, on the process taking place in the room. In the case of semi-conductors, a 24-hour sample may be analyzed chemically to be certain that specific contaminants are below an allowable level. Where dust particles are themselves of concern, levels may be evaluated by such divergent techniques as establishing a maximum number of allowable settled particles in an uncovered petri dish, to sampling with a membrane type filter paper for a given period of time, and subsequent counting of collected dust particles under a microscope.

Critical applications require critical techniques. However, regardless of the degree of criticality, monitoring should follow an established routine. Laxity may permit gross contamination to occur before its existence is recognized. When this happens, the reestablishment of satisfactory levels may only be achieved at the expense of much maintenance work and extensive white room "down time."

In the above review it has been possible only to outline the general problems which will be met in

(Please turn to page 51)

TABLE 1—AVERAGE CONCENTRATION (Particles Per cc)

Particle Size Range (Microns)	*Room Air At Rest*	*STERIL-SHIELD With Electronic Air Cleaner*	*STERIL-SHIELD With ABSOLUTE Filter*
1.0–1.4	37.70	1.33	0.0
1.4–2.0	7.93	0.25	0.01
2.0–2.8	2.50	0.09	0.01
2.8–4.0	1.82	0.05	0.01
4.0–5.6	0.70	0.0	0.00

Fig. 5: *Group of* Sterishield *hoods shown in use. Upper section with glass panel is lowered and in place so operator cannot contaminate the product with dandruff, hair or skin flakings. Hoods have own lighting. The lower section slides.* Courtesy: Bardon Corp.

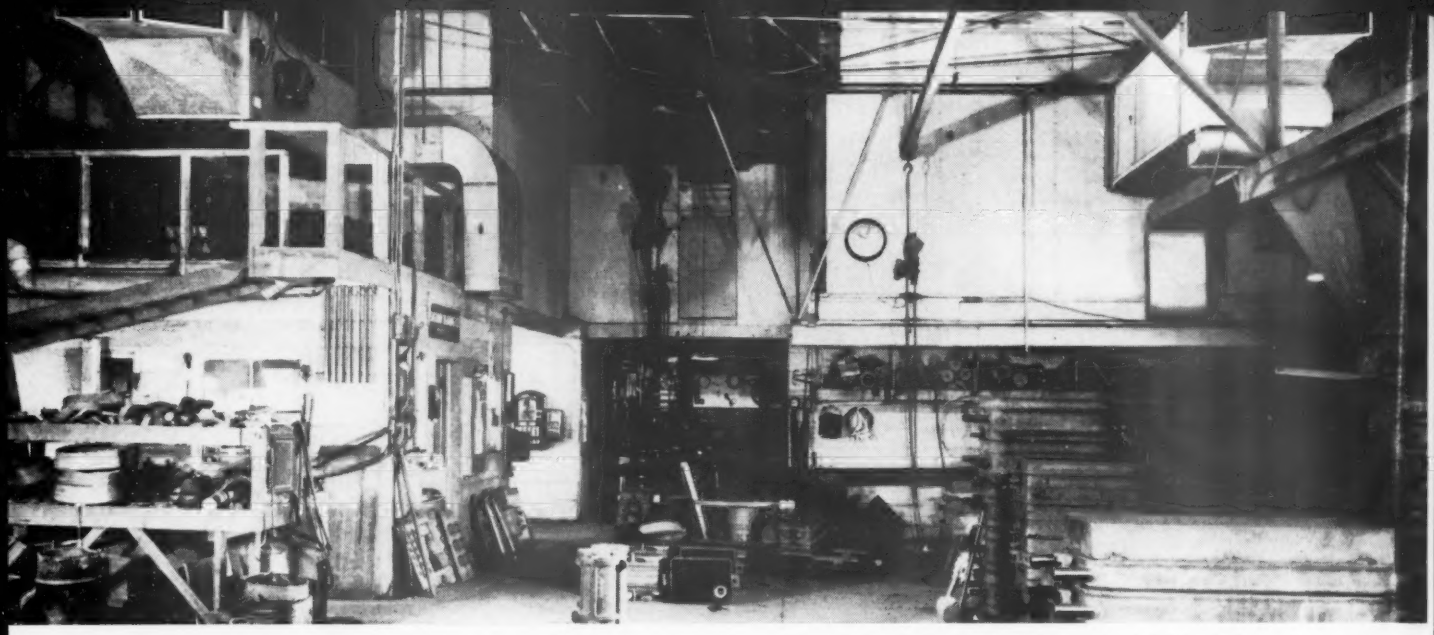

Fig. 1: *In the photo above, make-up air units can be seen at top left and right in this foundry application. Note that make-up air units are located near exhaust equipment.*

Make-up Air Design Tips

Is your plant "starved" for air? Doors hard to open? Workers complain of chills in winter-time? This practical advice about make-up air installations can help you end "starved air" conditions.

by C. J. Low
Application Engineer
Jackson & Church Division,
York-Shipley, Inc.

WITH NEW INDUSTRIAL PROCESSES and their dust collection devices robbing air from the factory buildings . . . with stricter industrial hygiene standards calling for purer air that means added ventilation requirements . . . many "modern" plants are on the verge of operating in a partial vacuum as far as make-up air is concerned. For every cubic foot of air, contaminated or otherwise, exhausted from an enclosure, whether it be a chicken coop or a factory, another cubic foot of tempered, conditioned, often filtered air must be supplied in return.

What are the problems associated with an "air starved" factory building? First, inside pressure is negative. This means outside, often dirt laden air is pulled into the building through cracks, around windows, under doors. Outside wall areas are drafty, poorly heated, workers complain of chilly conditions. There's a lot more dust and dirt than usual on work benches, machinery, and desks.

Equally as important, exhaust systems supposed to remove toxic vapors and materials, lint, irritants, sand and other abrasives, won't work as designed. The ventilation engineer may have spent hours laboring over a hot slide rule, and the blowers, hoods and ducts may have been sized and installed just right. Still, there's spill-over into the plant, fumes or dust aren't picked up by exhaust system. So more blower capacity is added and *still* the system won't work. So the engineer begins to think the hood design is wrong, or maybe the ductwork isn't right, or the blower is installed improperly. *Now* is the time to look at the make-up air system.

Make-up air systems must perform two principal functions: (1) Supply air from another source at the same rate it is exhausted from the space. (2) Temper, or heat air, usually taken directly or indirectly, from outside, to eliminate an added heat load on the principal heating plant.

"Starved Air" Symptoms

During the heating season the make-up air system should operate only when the exhaust system is in operation to avoid unnecessary heat release, unless the system is dual purpose, performing other functions.

Other symptoms of a "starved air" plant, in which more air is exhausted than introduced into the plant are:

1. Doors may fail to open or close properly.
2. Foreign odors become objectionable.
3. Burner equipment performs erratically and

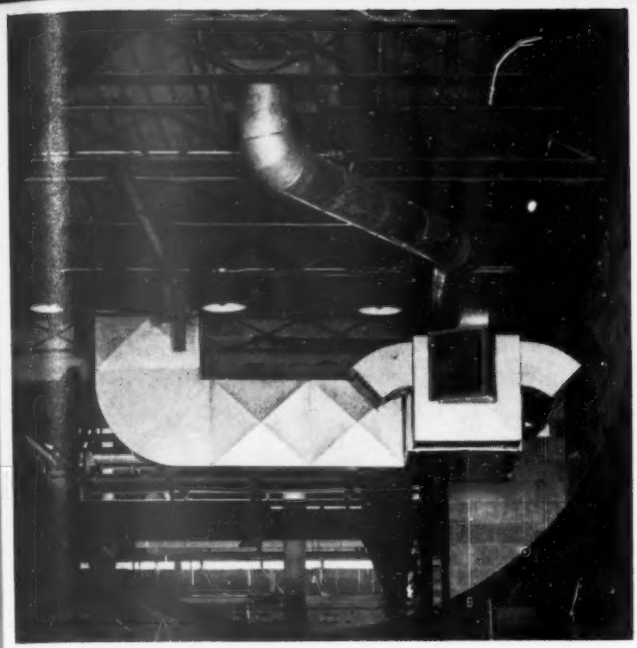

Fig. 2: *This make-up air unit heats loading dock area, prevents cold air from being pulled into plant through loading area. Directional outlets spray warm air toward areas requiring heat.*

the lack of oxygen may cause poor combustion, even cause release of CO in the building. Down drafts may lead to circulation of combustion products throughout the structure.

Spray Booth Adds Problem

In one case a tenant who leased a new, modern building, installed a paint spray booth with exhaust. The original heating plant was sized only for heating the structure, with no allowance for the exhaust of large amounts of heated air. After starting production, heating equipment performed erratically, failed to hold desired inside temperature. The cause – lack of combustion air and excessive infiltration. The remedy – taking combustion air for each burner directly from outside, isolating burner from the building, and adding furnace equipment to deliver outside air to the plant at 70 F. Negative pressures were eliminated, as was excessive infiltration of cold outside air. Main heating plant was relieved of make-up air heat load.

In this instance, the exhaust system was electrically connected so as to operate only when the make-up air system operates. However, the make-up air system could operate independently of the exhaust system for summer ventilation.

In another instance, a manufacturer built a new wing for storage and shipping. It was not considered necessary to build the wing as a tight structure, nor to heat over 50 F. Shortly after the new wing had been put into use, the common wall between the old and new section was removed for easier access to the wing. No sooner was the wall down than complaints began to develop.

Machine operators in the old area spoke of cold drafts; the shipping foreman could no longer hold 50 F in the new wing; furnace units were acting up. Investigation disclosed that an exhaust system in the old area stole make-up air from the new wing. So the new wing, under negative pressure, was drafty due to easy infiltration of cold outside air. Heat loss was greater than capacity of heating unit installed therein. The remedy: furnace units were added to supply make-up air from outside to relieve the "pull" from the older section.

Battle of Exhaust Systems

Sometimes a new exhaust system fails to produce as planned and even adversely affects nearby exhaust systems. This battle of exhaust systems can be relieved locally by bringing in tempered make-up air. This example points up the erroneous assumption that a building in its entirety is affected by insufficient make-up air. The problem may exist in one area only and not necessarily include the whole structure.

Make-up air need not necessarily be all or partly outside air. Heated air removed from one area can be delivered to another, if this air is not contaminated. Occupied areas near the exhaust system can be heated by exhaust but still warm air. Storage areas containing non-critical or sealed materials, loading and unloading docks are among the other areas that can be so heated. Such heating can be controlled by use of modulating thermostats and motors operating main and relief dampers. Heating can be an on-off operation, controlled by a two-position damper manually set, one position for heating, other position redirecting air when heating is not required.

Material handling systems need not cause an added heat load if properly designed for recirculation. Too often, waste removal systems use some type of

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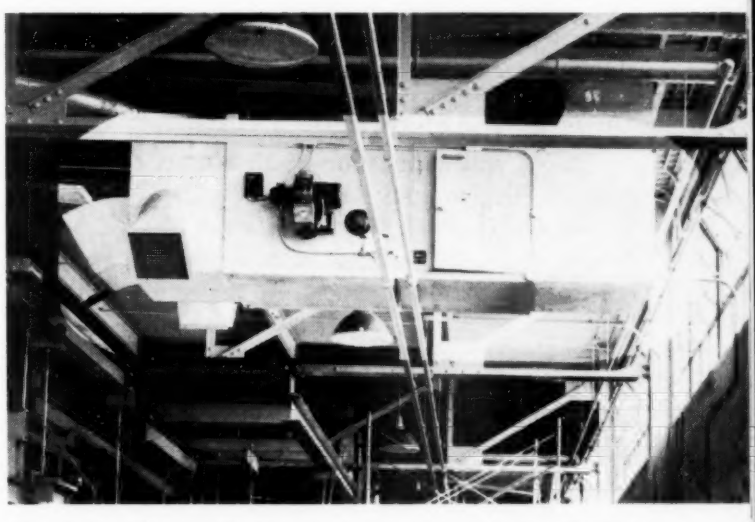

Fig. 3: *In this application, make-up air units are located along outside wall of building, where they can throw warm air from directional nozzles toward floor and center of building.*

(Continued from preceding page)

separator whereby the material is deposited in storage bins or containers and the air discharged to the outside. If the system is insulated, the air can be returned to the same area from which it was taken, with little if any heat loss. Properly designed, the return system can result in added ventilation.

Introducing Make-up Air

When designing a make-up air system for year 'round operation, make-up air can be introduced in the cleanest area of the plant. Air will then flow from the point of introduction into the plant toward the negative pressure areas, where exhaust occurs, carrying with it undesirable products not originally planned to be handled by the exhaust system. Thus as the air sweeps through the plant from point of introduction, over machines, operators, etc., it picks up odors, dust, and vapors. The make-up air carries these undesirable substances to the exhaust hood where the exhaust system removes both the contaminants for which it was designed plus all of the contaminants of plant air by ventilation from supply to exhaust areas.

Warm air furnaces that can be used for both heating and summer ventilation may be the "heart" of make-up air systems. Type of furnace used is as varied as their application. First consideration in selecting a furnace for make-up air is its air capacity as against the designed static pressure; second is its heating capacity. This is because ratio of air to heat, cfm to Btu, is usually much greater for a make-up air application than for heating applications.

The furnace is generally a modified version of standard equipment. It may be connected to an extensive duct system of appreciable static resistance or may operate on free discharge with little if any external resistance. Heating capacity may be calculated by the equation Btu/hr = cfm × TD × 1.08. "TD" is the difference between the temperature of air entering and leaving the unit. All calculations should be based on cfm of standard air.

Design of Air Outlets

Design and application of air outlets is as important as temperature control. Terminal velocities, where air reaches the living zone, should be no greater than 50 fpm for heating and 100 fpm for cooling; providing temperature of the air stream striking the occupant is reasonably normal to the surrounding atmosphere.

In areas where excessive heat is encountered, such as working zones near heat treating or baking ovens, the make-up air system can supply cool air to reduce heat gain to personnel and improve working conditions. The make-up unit can supply air at the required reduced temperature, which after mixing with inside air, will be tempered to achieve desired results.

Location of outside air intake for make-up air units must be selected with extreme caution. Air inlets must be located so as not to pick up contaminants from outside air. Consideration must also be given to inlet location in relation to air temperature. For example, one engineer found, by accident, that during summer months air on the east side of the building was 10° cooler than air on the west side. The building faced east, had a large, well kept lawn, several shade trees and the area adjacent to the building was not subject to afternoon sun. The area on the west side of the building, on the other hand, was a rear parking lot and was not only exposed to hotter afternoon sun, but also to reflected heat from cars and from the black-top parking space. By taking air from the east side of the building, the air engineer was able to supply ventilation air 10° cooler than had he taken it from the west side. Thus microclimatology is a factor in locating make-up air intakes.

Interesting Case History

A case history in make-up air is shown by the drawing in Figure 4. The building is a foundry. To keep offices reasonably clean and free from foundry dusts, the office heating unit was selected to take two-thirds outside air and recirculate the balance. Thus the office is under positive pressure, isolating it from airborne dirt of the foundry operation.

Make-up air units for heating maintenance, pattern storage and sanitary facilities take all circulating

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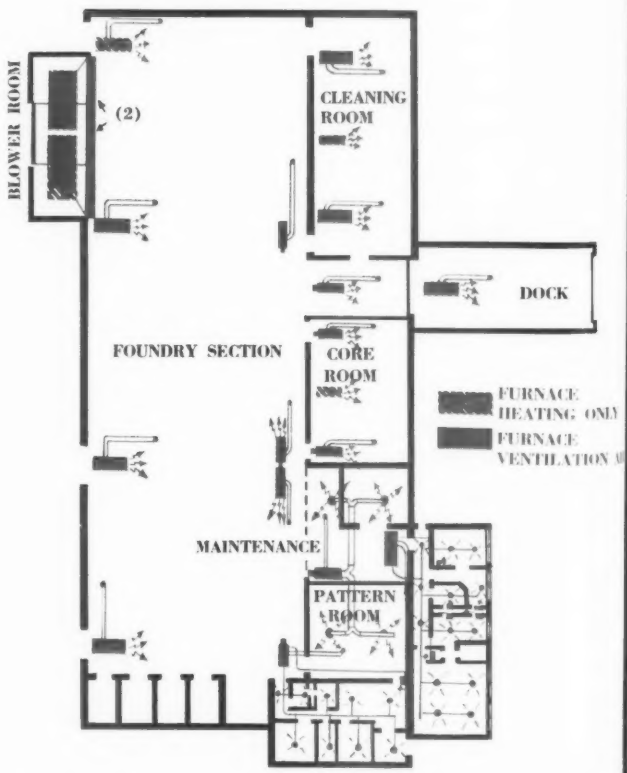

Fig. 4: *Typical layout for brass foundry. Heating furnace and ventilation make-up air units can be operated independently as needed.*

Heating and Cooling **IBM's** *Airborne Computer Plant*

The group of buildings housing the IBM airborne computer design group and assembly operations has built-in problems of heating and cooling. Here is how the design engineer met exacting temperature requirements.

by R. R. Miller
Senior Mechanical Engineer
Giffels and Rossetti
Detroit, Mich.

IN THIS DAY OF EARTH SATELLITES and intercontinental ballistic missiles a "beautiful campus" located on a picturesque hillside just each of Owego, N. Y., takes on an increased importance. On this 700 acre site, the I.B.M. Corporation has erected facilities for the development and manufacture of navigational radar and missile guidance systems. The new facility, complete with administration and cafeteria building, manufacturing building, two engineering buildings, fire house, boiler house and waste disposal building, is one of the latest additions to the I.B.M. Corporation Military Products Division. Employing approximately 3,300 people, the entire facility is air conditioned to satisfy both comfort and process requirements.

Design conditions were 95 F dry-bulb and 75 F wet-bulb in summer and minus 10 F in winter. Indoor design is 80 F dry-bulb and 50 percent relative humidity. Internal electrical heat gain from lights and equipment averages 7 watts/sq. ft. for the buildings on the site. Ventilation rates range from 1 cfm/sq. ft. with 25 percent outside air in the ad-

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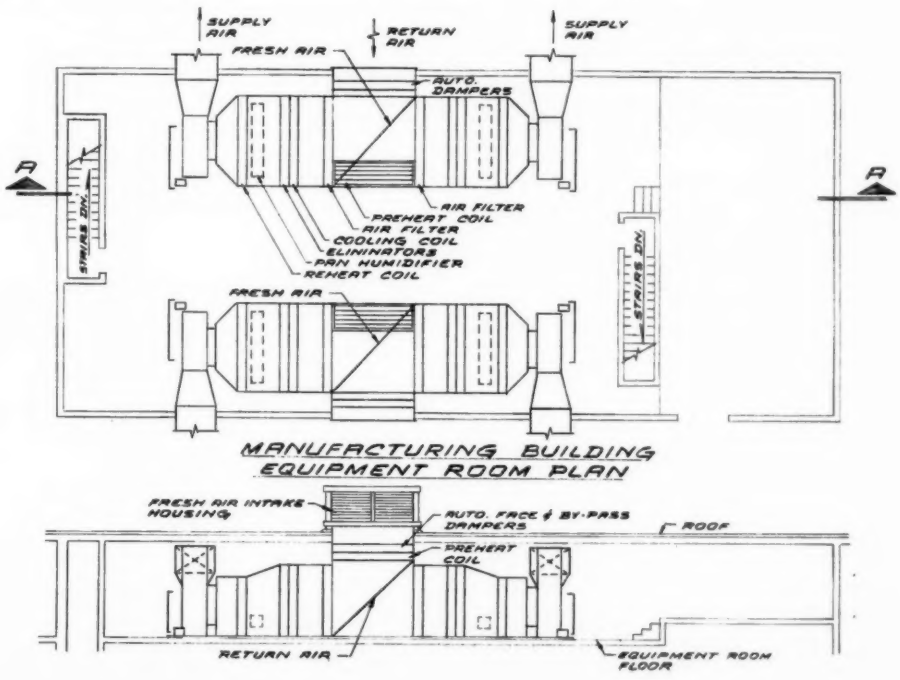

Fig. 1 *Here is a typical equipment room in a manufacturing building at IBM's new airborne computer plant at Owego, N. Y.*

(Continued from preceding page)

ministration building to 1.5 cfm/sq. ft. with 15 percent outside air in the engineering buildings and 2 cfm/sq. ft. with 22 percent outside air in the manufacturing building. All fan systems have manual control over the amount of outside air which can be supplied. All air is filtered with automatic roll-type filters for ease of maintenance.

Presently installed in the central boiler house are three 790 ton steam turbine driven centrifugal refrigeration machines. Steam is supplied at 150 psig by three package water tube boilers rated at 33,000 lbs. per hr. The turbines exhaust into condensers at 27-in. Hg vacuum. The water rate is 18 lbs. of steam/hr/ton. Compressor capacity variations from 40 percent to 100 percent with suction dampers wide open are obtained by a variable speed oil relay governor control.

For the present air conditioning load, chilled water pumps circulate 5,200 gpm of 45° water through approximately a mile and a half of piping to supply the 30 major build up fan coil systems located in sixteen equipment rooms in the various buildings. Control for all chilled water is by modulating 3-way by pass valves.

Flexibility of System

A major problem encountered was to design the fan coil systems and distribution systems to provide adequate flexibility for the rapidly changing requirements of the scientists and engineers who develop the airborne computers. The solution lay in the design of basic fan systems integrated into well located and functional fan rooms coupled with simplified distribution systems. Several different systems were used, each tailored to the operations and functions of the different buildings.

The first phase construction of the manufacturing building comprises 180,000 sq. ft., completely air conditioned. This building is served by 12 single zone low velocity fan systems of approximately 30,000 cfm each. These systems are laid out in pairs as shown in Fig. 1. Duct fingers reach out from each of the three equipment rooms located above the central core toilet rooms, through the truss space to the supply diffusers mounted at truss height. There are no return fans, but roof exhausters are tied into the system for relief at outside air supply quantities in excess of the 22 percent minimum.

Roof Cooling Saves 160 Tons

The manufacturing building roof, as are all roofs on the site, is flooded to a depth of 3 in. to decrease the amount of solar gain through the roof. Flooding the more than seven acres of roof on the site, has resulted in a saving in installed tonnage of approximately 160 tons.

The three story administration building connecting with the manufacturing building contains the

Fig. 2: *Machining operations area of the 180,000 sq. ft. manufacturing building. Completely air conditioned, building is served by 12 single zone low velocity fan systems.*

Fig. 3: *Bench operations area of the manufacturing building. Conditioned air is distributed from diffusers mounted at truss height. Roof ventilators are tied into system for outside air supply over 22 percent minimum.*

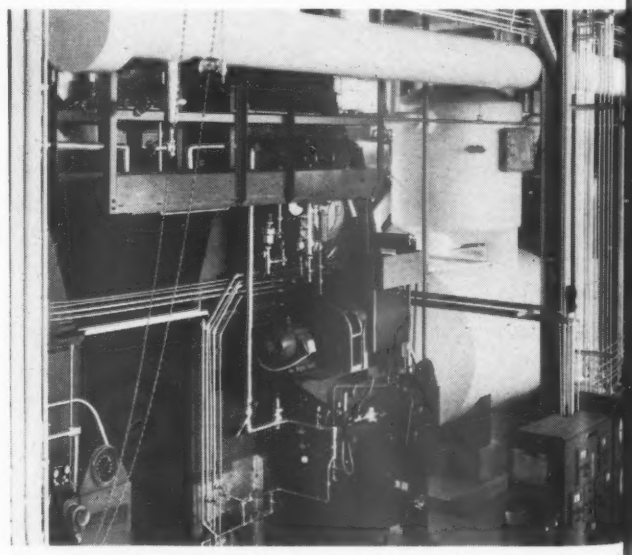

Fig. 4: *View of boilers, control panel, deaerator and water heater in the boiler house. Building also houses three 790 ton centrifugal refrigeration compressors.*

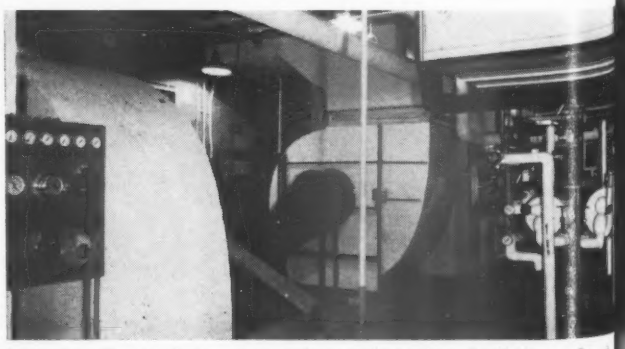

Fig. 5: *Typical fan room in engineering building No. 1 showing plenum and hot water converter section.*

kitchen and cafeteria. Facilities for feeding 612 persons at a time are located on the first floor. The single zone cafeteria unit also supplies a nominal amount of conditioned air to the kitchen when the kitchen hoods are not running. When the kitchen hoods are started, makeup air is taken from the cafeteria area and the amount of return air to the system is reduced. This helps to eliminate kitchen odors from the cafeteria and provides an excellent condition for the kitchen workers by supplying secondary conditioned air at approximately 5.5 cfm sq. ft. The full height south cafeteria windows which overlook the mile long approach road and the beautiful hills to the south are shaded by an eight ft. overhang of the second and third floors. This overhang provides a protected promenade which adds to the campus atmosphere of the site and decreases the air conditioning solar gain.

The rest of the administration building is modular in layout. Air conditioning is zoned from five hot and cold plenum fan units. Passages connect the administration building and the two engineering buildings.

Engineering Building

Engineering building number one is a 150,000 sq. ft. three story building. All the air handling equipment for the building is located in six equipment rooms, two on each floor. In order to keep as much building perimeter as possible available for occupancy use, equipment rooms are located in the center of the building on the second and third floor. The first floor equipment rooms are located at one side but occupy no valuable perimeter space, due to the land contour which makes this side of the first floor below grade. All outside air is taken in through the roof. There are twenty-five separate zones in the building, each requiring individually varying supply air temperature throughout the day. The proper supply air temperature is achieved by automatic mixing of air from hot and cold plenums. The hot air plenum is designed for a maximum temperature of 115 F. The cold air plenum is held at 55 F. For the most part, this mixing is done in the equipment rooms and low velocity ducts are extended to the zones. Intake and exhaust duct work is such that during the mild seasons of spring and fall, one hundred per cent outside air may be utilized for inside comfort.

Reheat Coil System

Engineering building number two is a 100,000 sq. ft. two story building. It follows the same general design as the larger engineering building except that, instead of mixing air from hot and cold plenums to satisfy zone conditions, a reheat coil is installed at each zone supply. Each floor has two cold air plenums from which zone ducts are tapped off. There are no suspended ceilings in the engineering buildings and all mechanical services are readily accessible. This will provide the maximum flexibility for zone changes and additions which will be required from time to time by I.B.M. as they provide us with better computers and guidance systems.

The winter comfort and safety of the busy and efficient people carrying out their important tasks was not overlooked in the modern design of this campus-like facility. Hot water radiation, designed to blanket the liberal quantities of glass during the cold winter of New York, is installed around the perimeter of all buildings to assure year-round comfort. Sloping

(Please turn to page 51)

CREDITS

Sheet Metal Contractor: *Levi Case Co., Schenectady, N. Y.*
General Contractor: *Crow-Smith, Johnson City, N. Y.*
Mechanical Contractor: *A. J. Eckert, Albany, N. Y.*

EQUIPMENT INSTALLED

Air Filters: *American Air Filter Co.*
Fans: *American Blower Corp.*
Centrifugal Refrig. Mach.: *Carrier Corp.; Worthington Corp.*
Turbines: *Terry Steam Turbine Co.*
Coils: *Marlo Coil Co.; Aerofin.*
Fin-Tube Radiation: *Vulcan Radiator Co.*
Diffusers, Grilles, Registers: *Tuttle & Bailey.*

Fig. 6: *General office area in engineering building has heavy lighting load, is fully air conditioned.*

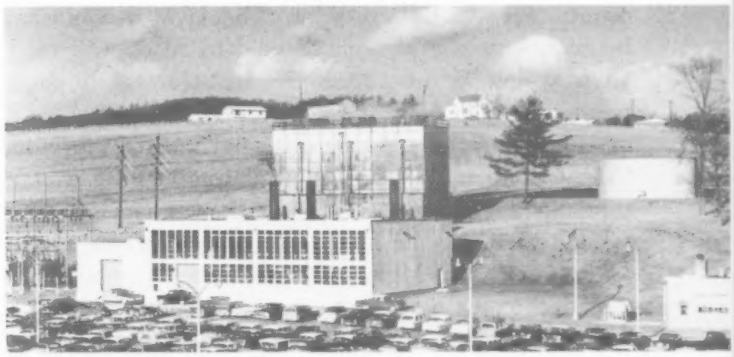

Fig. 7: *View above shows the central boiler house, cooling tower, electrical substation and emergency vehicle building at IBM Owego Military Products Div.*

Techniques for Uranium Dust Control

PART I

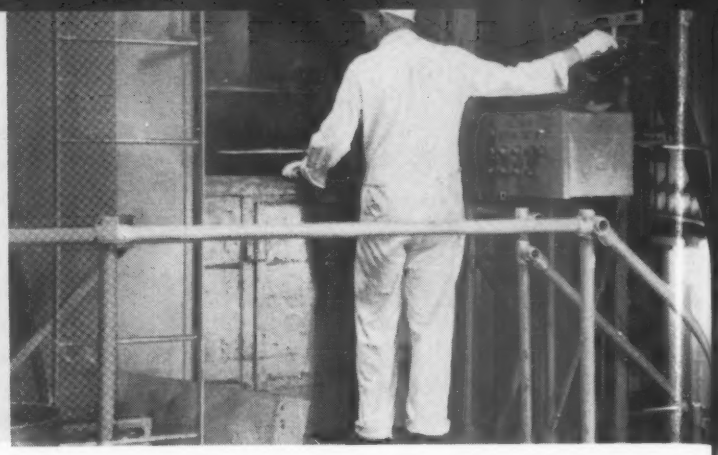

Fig. 1: *From this dumping station the empty drum and lid go through a washer and drier to eliminate any possible contamination after "empties" leave plant.*

by Knowlton J. Caplan
Assistant Manager of General Engineering
Mallinckrodt Chemical Works
St. Charles, Mo.

This first of a series on dust control in the uranium processing industry may help answer some of your own toxic or hazardous dust collection problems.

THE REFINING OF URANIUM consists of the chemical processing of rich ore or ore concentrates to highly purified uranium salts or metal. The major production of uranium salts is as the tetrafluoride, UF_4, which is converted to UF_6 and used in the gaseous diffusion plants of the Atomic Energy Commission to obtain isotope enrichment. Uranium metal is further processed into various shapes and clad for use in nuclear reactors.

In a typical refining process, the ore concentrate is first sampled for uranium content and then dissolved in nitric acid. The acid solution is extracted with a suitable solvent, such as tributyl phosphate in hexane, which extracts the uranium into the organic phase, leaving behind the impurities. The uranium is then re-extracted back into a water solution and concentrated by evaporation. The purified solution is decomposed by heating to drive off the nitrate, leaving UO_3 powder. The UO_3 is contacted by hydrogen gas in a fluidized bed reactor to form UO_2, which is then reacted with HF gas at high temperature to form UF_4. The UF_4 is mixed with magnesium metal chips and heated until a thermite-like reduction reaction starts, producing molten uranium metal and MgF_2 slag. The metal after solidification may be machined, rolled, extruded, etc., as desired. The MgF_2 slag is crushed, ground and screened to provide the refractory material for lining the steel reduction vessels.

Since the toxic, radioactive uranium main stream of the process is handled dry in all steps except digestion and solvent extraction, dust control is of major concern. Powdered UO_3, UO_2, and UF_4 are packaged for handling between process steps and for shipment as intermediates. Although some portions of the operations are continuous processes in closed vessels, other steps are conducted on a batch basis with attendant dust problems.

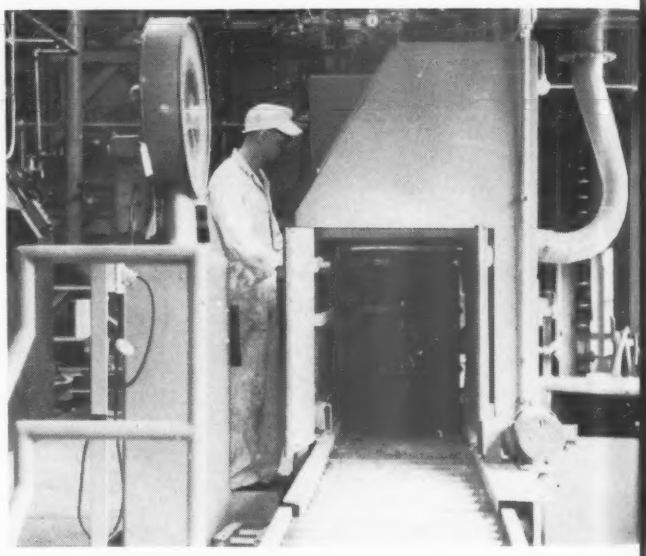

Fig. 2: *Drum packaging hood shown above keeps dust out of room, prevents loss of material to dust collector, prevents contamination of outside of drum.*

The dust control techniques described here have in general succeeded in keeping airborne dust contamination below the maximum allowable concentration (MAC) of 73 micrograms per cubic meter, and have played an important part in preventing even a single case of uranium poisoning in the refinery.

High Standards Required

The basic principles of industrial dust control are adequate for uranium processing only if very carefully designed and built to provide dust control just one notch better than typical of modern industry. It is necessary to provide control hoods for all foreseeable dust sources arising from routine operation. Some

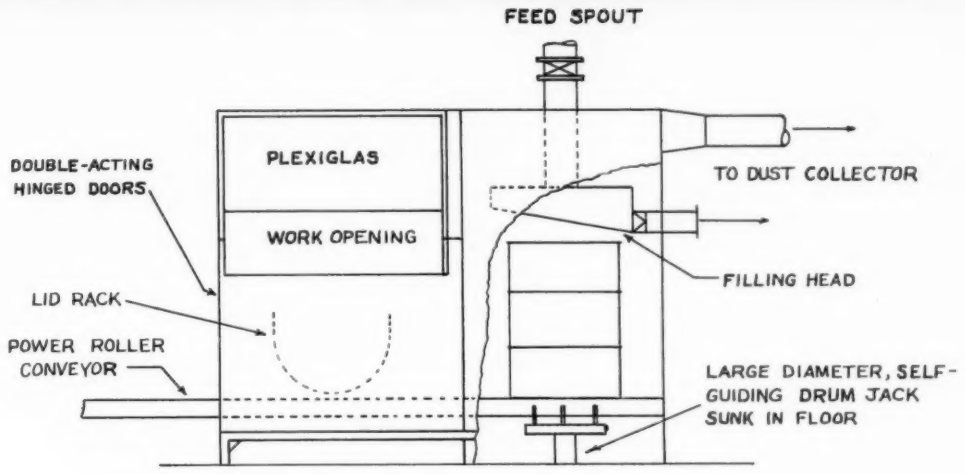

Fig. 3: *General arrangement of production drumming station, showing general equipment layout.*

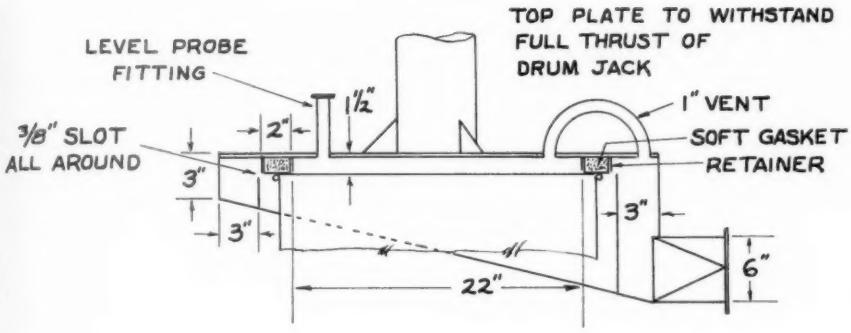

Fig. 4: *Cross section of production packaging station showing cross section of filling head.*

types of maintenance work, especially if repetitive, require special dust control design.

It is necessary to provide dust enclosures for housed equipment, such as pulverizers or vibrating screens, normally regarded as "dust tight." Other types of equipment such as bucket elevators require especially designed housings with all-welded seams or gasketed closures. Chutes and spouts require heavy, gasketed flanges and flexible boots with integrally-molded flanges.

All process buildings require make-up air supply systems designed to minimize cross-drafts at dust control hoods.

Dust collection equipment must be dependable, and of high efficiency to prevent air pollution as well as loss of valuable product.

Because uranium dust presents a real potential health hazard, duct work is designed by the static pressure balance method so that unauthorized tampering with dampers will not upset the system. Adequate transport velocities of at least 3500 fpm are used, and ductwork is carefully designed to eliminate plugging. Design data of the "Industrial Ventilation Manual" ([1] [2] [3]) has been found adequate for most problems.

In the absence of objectionable cross-drafts, and when the dust generating source is not violent, hood face velocities of 250 fpm are adequate for the smaller work openings two to three sq. ft. in area. Lower face velocities, down to 150 fpm, have been used for large openings of 50 sq. ft. or larger. Velocities as large as 1000 fpm have been required at small work openings where the dust-dispersal action is violent, as in chipping slag from metal. "Local exhaust" hoods near the dust source are usually inadequate, and the hood should at least partially enclose the operation.

Accessibility Important

It has been found important to provide hinged doors on dust enclosures wherever possible. When equipment inside a hood breaks down, the mechanic must perforce remove access panels to affect repairs. But replacing the panel later requires constant supervision if myriad nuts and bolts are involved. A hinged door, however, is quickly opened and just as easily closed. The integrity of the dust control is maintained without excessive supervisory effort, and the cumulative savings in maintenance time getting at enclosed equipment goes a long way toward paying for the doors.

Ore concentrates and uranium powders are frequently handled in 30 or 55 gallon steel drums. The dumping of this material is done in an enclosure provided with a power-actuated drum turnover device.

(Please turn to following page)

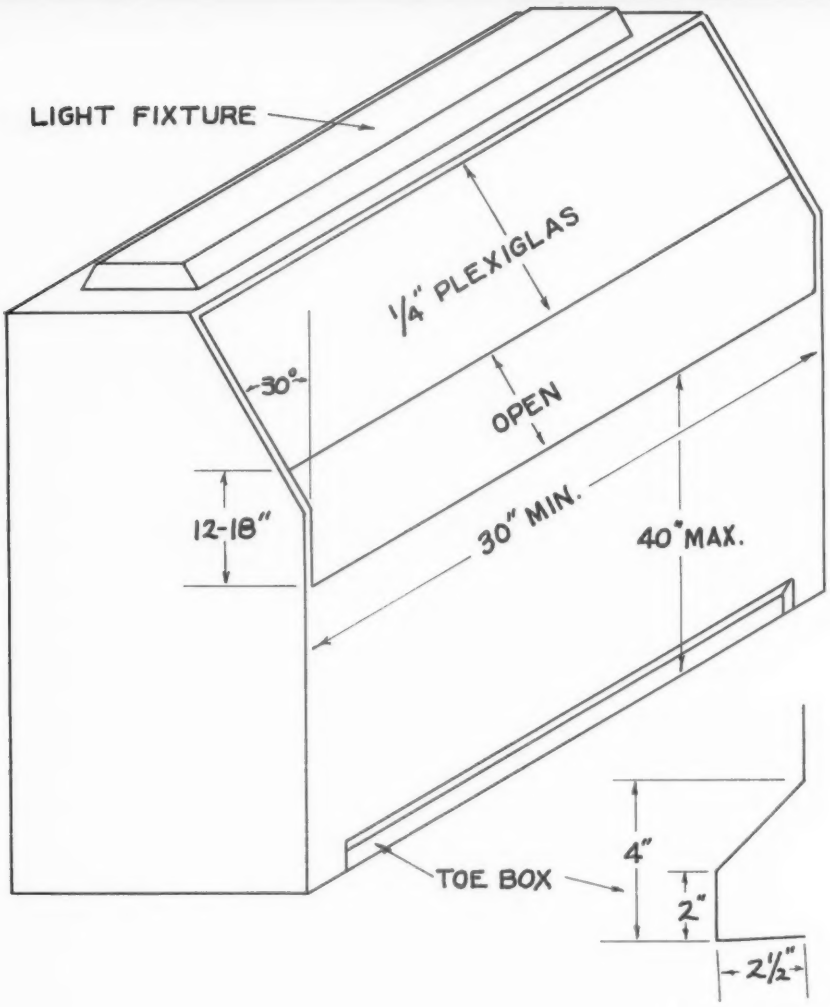

Fig. 5: *Drum filling station for uranium ore presents problem of work visibility and dust control. All work and tools are within 20 inches of window shown in the hood at left.*

(Continued from preceding page)

The operator removes the drum lid by reaching through a work opening and neither drum nor lid leave the ventilated enclosure until they have been washed. Production dumping stations, as shown in Fig. 1, convey the empty drum and lid through a commercial drum washer and drier before they are handled outside as empties. The contamination of the drum and lid will result in excessive airborne dust if handled outside the hood in production quantities.

"Bar room" doors or air locks are provided where drums enter or leave the enclosure on the roller conveyors. Sufficient air is exhausted to maintain a 250 fpm indraft at the work opening when doors are closed or 150 fpm at all openings when doors are opened, whichever is greater.

In the packaging of uranium powders into drums, several requirements must be met:

(1) Dust escape to the room must be prevented.

(2) Excessive loss of material to the dust collector must be prevented, especially if the material being packaged has been sampled for assay, particle size, etc.

(3) Contamination of the outside of the drum must be minimized.

Fig. 2 illustrates a drum packaging hood which successfully meets these standards. The drum is jacked up against a gasketed surface in the filling head prior to filling. The filling head is provided with a high velocity plenum to capture any dust escaping the seal. The entire operation is enclosed to act as a secondary line of defense in case of overfilling, and to minimize the spread of contamination from leakage or scattering of material from the filling head when no drum is in place under it. Fig. 3 shows the general arrangement of the equipment and Fig. 4 illustrates details of the filling head.

Enclosure Exhaust Rates

Enclosure exhaust rates are the same as for drum dumping. Filling head design provides for 250 cfm exhaust per sq. ft. of drum top area, 4000 fpm slot velocity, and 2000 fpm plenum velocity. These velocities, plus the sloped bottom of the plenum, prevent plugging with settled dust.

Enclosures of this type, where a man works through openings in an enclosure, present several

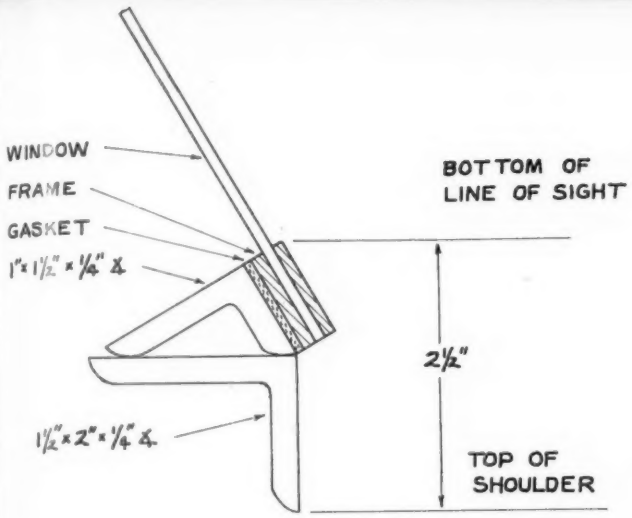

Fig. 6: *Arrangement shown permits use of long windows requiring bottom edge support or installation of shielding against beta radiation hazards. Good visibility is retained by reducing space between top of arm hole and bottom of the window, as shown here.*

"human engineering" problems. It is necessary for the man to both see and reach his work. Breaking back the window as shown in Fig. 5 permits the head to be bent forward slightly, affording a more comfortable position and better visibility. The toe box enables him to get just a little closer. Other dimensions shown are pertinent. Even so, all work and tools should be located within 20 inches of the hood face – the limit of comfortable reach.

For the usual work opening the bottom of the Plexiglas window may be unsupported. For long windows requiring bottom edge support, or where beta radiation hazards require shielding, the space between the top of the arm hole and bottom of the window must be minimized in order to permit full reach and good visibility, by the system of Fig. 6 for example.

Pulverizer Problems

Equipment such as pulverizers, shaking-deck screens, etc., have commercial "dust-tight" enclosures but these are not satisfactory for uranium dust control. It is not advisable to exhaust air directly from the equipment housing because excessive amounts of product will be removed to the dust collector. The problem has been solved by providing a dust hood around the equipment housing, constructed of removable sections for easy maintenance access. A permanent bottom pan or hopper is installed, and the dust collection duct is connected to this permanent section (see Fig. 7). The upper sections are constructed with angle supports so as to be completely self-supporting, with split lines at shaft holes, and are fastened to each other with quick-removal fasteners such as Link-Belt spring clamps. There is no permanent steel frame above the bottom pan, and thus the equipment is highly accessible when hood sections are removed. Exhaust volumes required are nominal, usually about 300 cfm, just sufficient to maintain a suction on the housing and an in-draft at cracks and shaft holes. END PART I.

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1. *"Industrial Ventilation — A Manual of Recommended Practice,"* 5th ed. Committee on Industrial Ventilation, Post Office Box 453, Lansing, Michigan, 1958.
2. Allen D. Brandt, *"Industrial Health Engineering."* John Wiley & Sons, New York, 1957.
3. W. C. L. Hemeon, *"Plant and Process Ventilation."* The Industrial Press, New York, 1955.

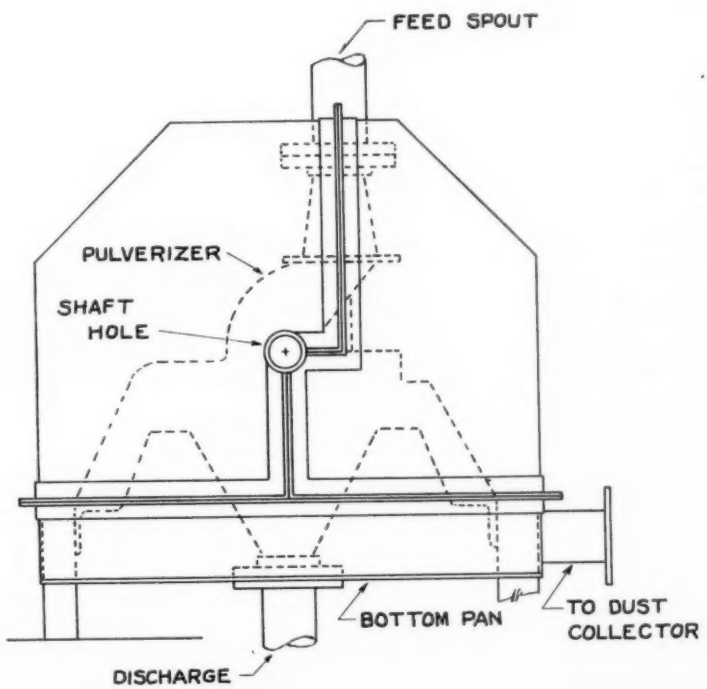


Fig. 7: *Pulverizer hood is self-supporting for easy access. The exhaust volume is usually 300 cfm, just enough to maintain suction on housing and an in-draft at cracks and at holes.*

Air Pollution Control Association
Hotel Statler-Hilton, Los Angeles, June 21-26

What the Exhibitors Will Be Showing

Airkem, Inc.
Booth No. 113

Products exhibited: Industrial odor counteractants for stack, atmosphere, and plant air quality control.
Attending booth: John M. von Bergen, director, industrial application; Nicholas K. Post, manager, Industrial Div.; Wendell M. Irwin, Los Angeles Airkem distributor.

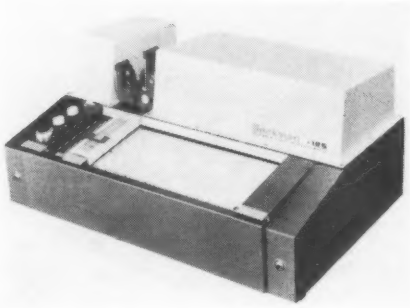
American Air Filter Co., Inc.
Booth No. 131

Products exhibited: AAF Electro-Mist electronic oil mist and fume collector for high speed cutting and grinding operations.
Attending booth will be: R. H. Nelson, manager, Pacific region; R. C. Taylor, manager, Los Angeles branch; W. B. Polhemus, manager, San Francisco branch and sales engineers R. V. Sloan, C. J. Bressoud, J. A. Bogen, John Hall, W. E. Nero, E. Mack Miller and J. S. Louden.

American Incinerator Corp.
Booth No. 102

Buell Engineering Co., Inc.
Booth No. 130

Products exhibited: Cyclone collector, electric precipitator, LR collector.
Attending booth: S. J. Pascual, vice president-sales; H. C. Dohrman, vice president-engineering; C. A. Gallaer, assistant chief engineer.



Beckman Instruments, Inc.
Booth No. 117

Products exhibited: Infrared spectrophotometer, pneumatic recording industrial gas chromatograph.
Attending booth: Mark K. Howlett, marketing manager; John M. Manypenny, assistant marketing manager; Roy Brown, process instruments sales manager; Paul Paules, western regional sales manager; T. J. Guerin, sales engineer.

Caloric Appliance Corp.
Booth No. 104

Products exhibited: Automatic gas disposer.
Attending booth: Harry S. Walker, sales promotion manager; George Ellis, divisional manager.

Encyclopedia Britannica, Inc.
Booth No. 105

Business News Publishing Co.
Booth No. 108

Products exhibited: AIR ENGINEERING magazine, new publication in the fields of air pollution control, air moving, and air conditioning.
Attending booth: Edward L. Henderson, publisher; Eugene A. Sloane, editor; J. A. Hannon, western advertising representative.

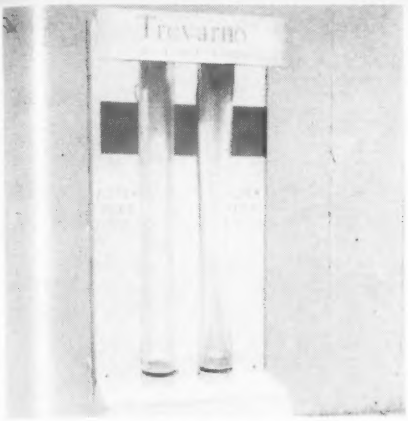
Catalytic Combustion Corp.
Booth No. 134

Products exhibited: Catalysts and catalyst systems for air pollution control, heat and power recovery from a variety of industrial processes.
Attending booth: R. J. Ruff, president; P. H. Goodell, vice president-sales; Robert R. Derber, district manager; Robert Allgeier, district representative.

Chemical Construction Corp.
Booth No. 101

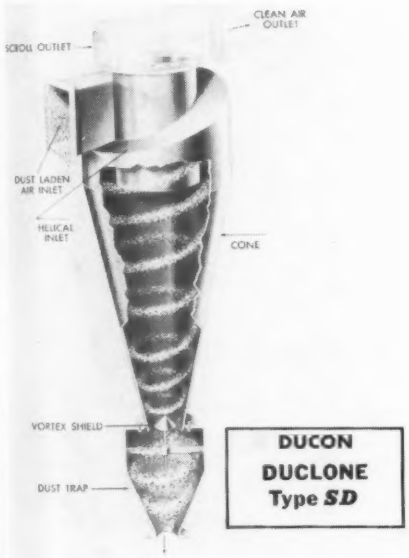
Products exhibited: Plexiglas working model of a typical P-A venturi scrubber.
Attending booth: H. P. Willett, manager; James A. Gross.

Morse Boulger Destructor Co.
Booth No. 121



Coast Mfg. & Supply Co.
Booth No. 118

Products exhibited: Trevarno Filter-Flex glass tube filters.
Attending booth: Larry T. Nelson, manager, Filter Div.; Victor Averill, production foreman; Allen Repp, representative.



Ducon Co., Inc.
Booth No. 114

Products exhibited: Cyclone collector, centrifugal and dynamic washers.
Attending booth: R. R. Leech, vice president and general manager.

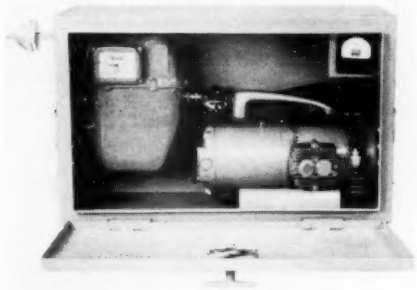
Koppers Co., Inc.
Booth No. 133

Products exhibited: Innovations in electrostatic precipitator engineering which Koppers has developed in the last few years, 12 recent precipitator installations in various industries.
Attending booth: D. L. DeVries, manager, Industrial Gas Cleaning Dept.; J. L. Phillips, manager, advertising and promotion; S. F. Fedan, manager, western district; R. L. Reveley, sales engineer, western district; R. A. Denbroeder, chief engineer, Industrial Gas Cleaning Dept.

Oxy-Catalyst, Inc.
Booth No. 128-129

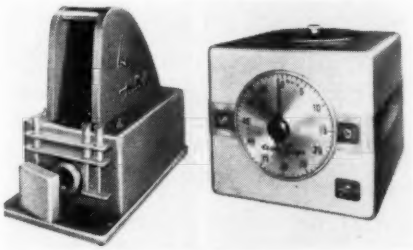
Western Precipitation Corp.
Booth No. 122

Products exhibited: Precipitator, Multiclone, Dualaire, Therm-O-Flex, Turbulaire-Doyle Scrubber.
Attending booth: Robert F. Stewart, vice president; R. W. Hermanson, advertising manager; R. J. Plass, manager of Southwest office; D. B. Perliss, E. R. Lawlor, G. G. Schneider, product sales managers.



Gelman Instrument Co.
Booth No. 112

Products exhibited: Fast response bivane to measure vertical and horizontal wind components; tape sampler that automatically samples air and provides record of pollution on moving paper tape; high volume air sampler for use with fiberglass filters; unbreakable membrane filters; aerosol filter holders, stack filter holders, glass fiber filter, nuclear air sampler, vacuum pumps, and sequential sampler.
Attending booth: C. Gelman, president; R. Gelman, treasurer; C. Hacker, engineer.

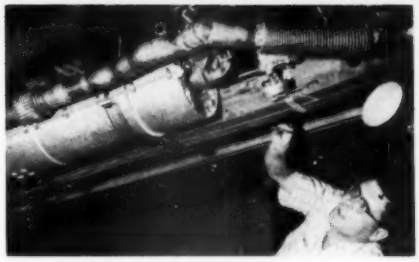


Mine Safety Appliance Co.
Booth No. 135

Products exhibited: particle size analyzer, ionization chamber, portable oxygen indicator, carbon monoxide tester, combustible gas indicator.
Attending booth: J. P. Sherwin, assistant sales manager; J. L. Riehl, sales engineer.

Perkin-Elmer Corp.
Booth No. 115

Products exhibited: Infrared spectrophotometer with 40-meter cell; vapor fractometer with ionization detector; flame photometer; spectrophotometer.
Attending booth: William J. Schenck, regional sales manager; Donald Frankel, Paul Amrhein, sales representatives; Paul C. Hutchinson, Nate Brenner.

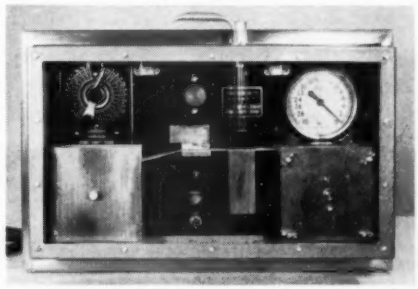


Ramo-Wooldridge
Booth No. 132

Products exhibited: Automobile afterburner that eliminates 90 percent of smog producing hydrocarbons found in automobile exhausts.
Attending booth: Dr. Stuart Ridgway, inventor; John Lair, Woodrow Gaines, L. G. Hoover, Charles Wacker.

Joseph Goder Incinerators
Booth No. 136

Products exhibited: None. Literature available.
Attending booth: Richard Goder, president; Wayne Breisch, sales manager.

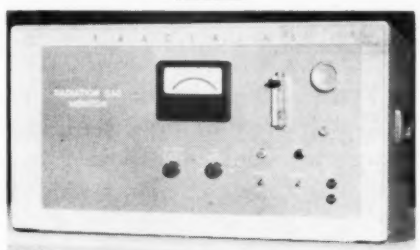


Research Appliance Co.
Booth No. 116

Products exhibited: Hydrogen sulfide sampler, smoke sampler, spot evaluator, millipore sampler, sequential sampler, micro bellows pump.
Attending booth: E. E. Fleck, pres.

Research-Cottrell, Inc.
Booth No. 137

Products exhibited: Gas flow model study display and Cyclo-trell dust collector display.
Attending booth: W. W. Moore, vice president for sales; R. H. Betchley, district sales manager; E. G. Lassen, advertising assistant; R. Sferra, sales.



Tracerlab, Inc.
Booth No. 111

Products exhibited: Sulfer dioxide tritium monitor.
Attending booth: Maurice Warren.

(Continued from page 16)

Caddy Air Sampler

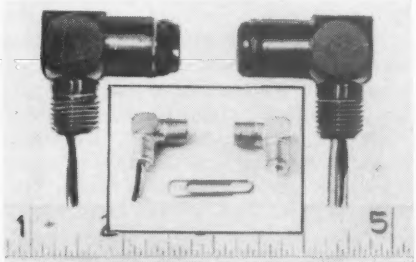
New Hi-Volume caddy air sampler samples dust, fumes, and gases. It inhales air at 4 cfm and collects enough dust on 2 or 3 in. filter disks to perform chemical analysis. Membrane, glass fiber, or paper filters may be used.

Vacuum pump is mounted on cart with 6 in. rubber wheels for moving to sampling locations. Air mover is actuated by graphite ringed pistons driven by ⅓ hp motor that never needs lubrication.

Source: *Gelman Instrument Co., Dept. AE, Chelsea, Mich.*

Electric Eyes

Sub-miniaturized electric eyes only ⅞ in. long have been added to the ESS line of miniaturized light sources and photounits that had been made as small as 1½ in. long.



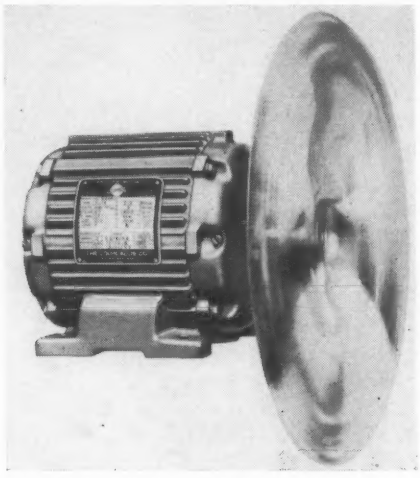
New units were designed especially for use with the company's regular control relay IRC-5 to provide modulation of both light strength and photounit sensitivity giving exceedingly precise triggering of light differences both by transmitted or reflected light.

Source: *Photomation, Inc., Dept. AE-M, Bergenfield, N. J.*

Air-Over Fan Motors

New "Air-Over" fan motors in ratings from 1 to 125 hp are designed for quiet operation in all air moving installations where a motor drives a propeller or axial flow fan.

Motor design makes use of air circulated in these installations to cool the motor so that maximum horsepower can be produced from a minimum motor size.



Individual motor nameplates indicate three hp ratings (nominal, operating, and maximum hp) that can be achieved by varying the air velocity across the motor.

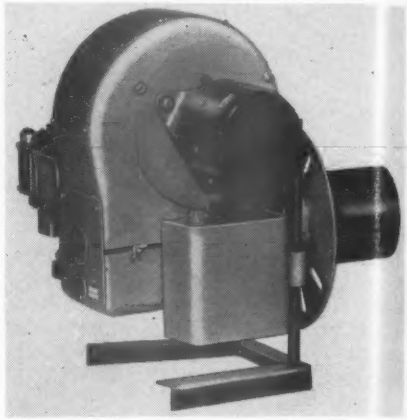
The motors are available with foot or flange mountings, in totally enclosed and explosion-proof enclosures, and are suitable for vertical or horizontal mounting.

Source: *Louis Allis Co., Dept. AE-P, Milwaukee 1, Wis.*

Gas Conversion Burners

New series of forced draft inshot gas conversion burners comes in two basic models with AGA listed inputs of 75,000 to 225,000 Btu and 150,000 to 400,000 Btu.

"Contractor" series burners are available in 5, 8, 10, and 15 in. usable blast tube lengths, 4 in. tube diameters, and either adjustable flange or stand mountings.

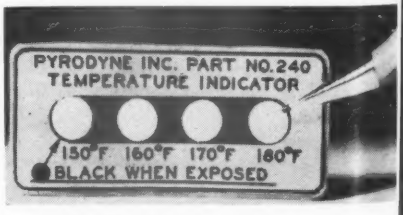


Adjustable orifice permits exact setting of Btu input by turning needle type orifice assembly with special tool provided. Separate adjustment of primary and secondary air allows exact adjustment.

Source: *Barber Mfg. Co., Dept. AE, 1052 E. 134th St., Cleveland 10, Ohio.*

Label Detects Hot Spots

A small plastic label, developed to detect overheating or hot spots, can indicate surface temperatures from 100 F through 700 F in a choice of 50 increments, with a tested indication accuracy of ± 1 percent. Present development activities are expected to increase the temperature range to 2000 F.



"Temp-Plate," backed with adhesive, registers a permanent change from white to black as the stated temperature level is reached. It will adhere to the mounting surface under a wide range of exposure conditions.

Source: *Pyrodyne, Inc., Dept. AE, P. O. Box 49972, Los Angeles 49.*

Use Communications Center, page 35, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

Taming Titanium Dust

Titanium dust from billet grinding posed an explosion hazard and nuisance. Dust must be collected over the 180 ft. traverse of the grinder. Here are details of dust collection system, including air pollution control equipment and exhaust set-up.

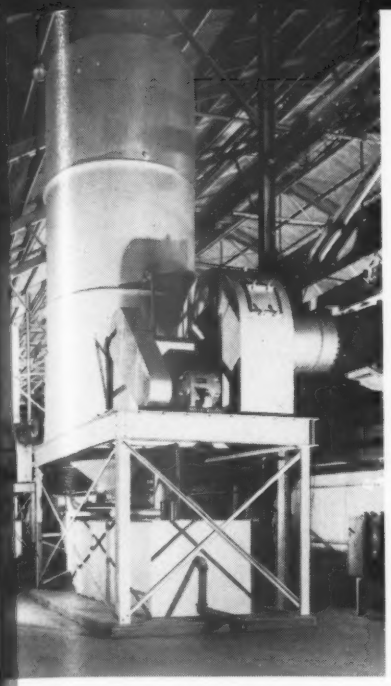


Fig. 1: *Air washers separate titanium dust from billet grinding operation. Dust is collected in slurry, with clean air exhausted to atmosphere.*

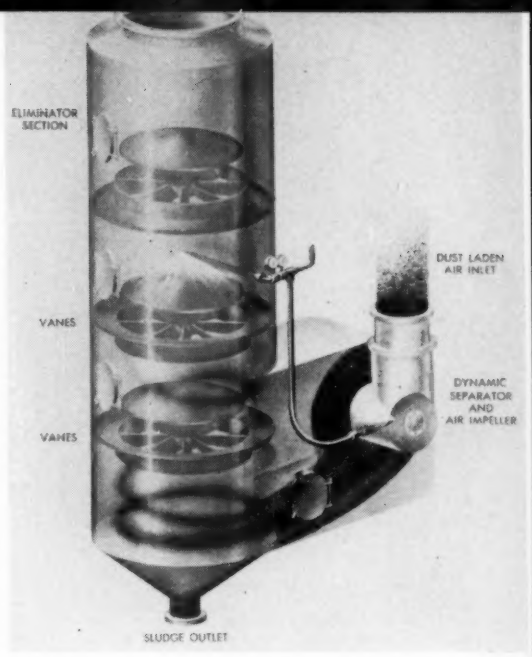


Fig. 3: *Action of air washer is shown above. Wetted dust travels upward against stream of water. Water and impinging action against vanes knocks dust out of air, prevents external air pollution.*

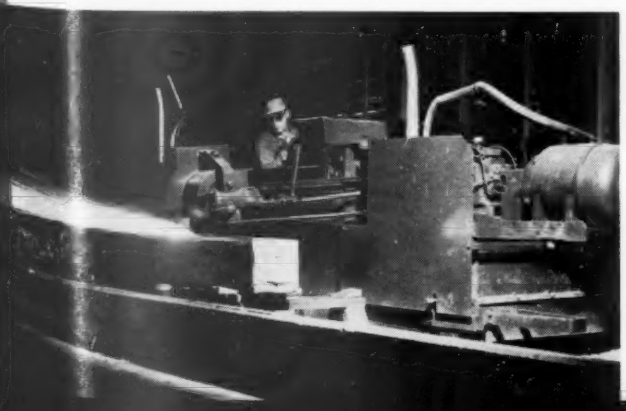
When Titanium Metals Corporation of America acquired the Ohio River Steel Division plant of Louis Berkman, Toronto, Ohio for conversion to a modern titanium fabricating plant, many changes were required due to the nature of the new product.

Among the major improvements necessary was the installation of an efficient dust control system in the titanium billet grinding department. Titanium grinding dust, like many other materials in finely divided form, poses a fire and explosion hazard. The dust control system at the TMCA plant was designed so as to meet by a safe margin the rigid air pollution standards of the state of Ohio and to assure clean, safe, healthy working conditions inside the plant.

The most prominent elements in the dust control system are three dynamic air washers (Figure 1). These washers are package units complete with dewatering tank and powerful fan which functions as a dynamic dust separator and exhauster. The exhaust stacks of the washers extend through the roof.

The source of the dust is the titanium billet grinders, one of which is shown in Figure 2. The need for dust collection equipment is dramatically indicated by the bright, flashing streaks of hot titanium particles emanating from the billet. The grinding operation, itself, is rather interesting. Large titanium billets, which have been forged into rectangular sections, are mounted on stationary saddles while the grinding machine travels back and forth on tracks running parallel to the billet. The heavy, adherent scale which forms on the surface of the billet during the hot forging operation is removed by the grinder to condition the billet for further fabrication into sheet, bar, rod and strip.

Fig. 2: *Adherent scale on titanium billet is ground off. Resultant dust is collected by wet washer to avoid contaminating both indoor and outdoor air, reduce indoor explosive hazard.*



One of the problems in the dust collection system was to collect dust along the entire length of the 180 ft. long traverse of the grinder. A 180 ft. long by 8 ft. deep by 4 ft. high hood was placed just above the grinder, with a galvanized sheet metal wall placed just behind the saddle so larger particles strike the wall and fall to the floor. The finer particles – which would contribute to a serious interior air pollution problem if left unchecked – are drawn by the blower system into the hood and subsequently into the dust collectors. Capture velocity at face of the hood is 125 fpm. The system has a capacity of 30,000 cfm at 5 in. s.p. Blowers are paddle wheel type, designed to slap the air to achieve some separation of titanium dust particles from the air stream. No duct clogging or wear due to abrasion problems have been reported.

(Please turn to page 52)

EQUIPMENT
Dust Collectors: *The Ducon Company.*

New Literature

Electronic Air Cleaner

New 16-page product bulletin (249A) which describes the Model B "Rollotron" electronic air cleaner has been made available by the American Air Filter Co., Inc.

Included are details of operation and electronic principle, an explanation of the agglomerator and storage sections, equipment drawings, capacity and dimension tables, specifications, a list of typical installations and a graphic description of the horizontal version of the Rollotron (known as the Type H).

Source: *American Air Filter Co., Inc., Dept AE-PD, 215 Central Ave., Louisville 8, Ky.*

Air Purification Equipment

Connor Engineering Corp. offers new 12-page Bulletin 108A, which describes and illustrates "Dorex" activated carbon air purification equipment – C cells and H canisters.

Data on equipment selection, installation, and application is provided. Also given is information on Dorex Replacement Service, lists of representatives and users.

Discussions of activated carbon and how to achieve conditions generally necessary for proper purification are included.

Source: *Connor Engineering Corp., Dept. AE, Danbury, Conn.*

Air-Cooled Condensers

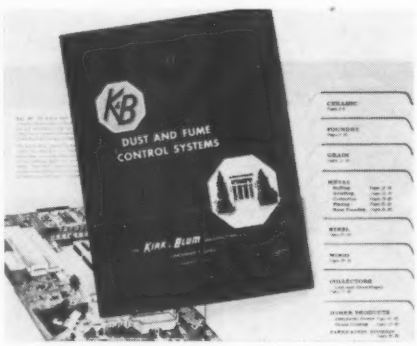
Two-page technical release ACC 522.07 on Drayer-Hanson air cooled condensers details multiple circuit application data and application information on CPC condensing pressure controls.

New rating charts for multiple circuit selection are keyed to selection samples. Diagramatic reproduction of operation of a CPC system illustrates relationship of components and outlines steps to avoid extremely low condensing pressures. A table shows additional refrigerant charge requirement for CPC systems.

Source: *Drayer-Hanson, Div. of National-U.S. Radiator Corp., Dept. AE, P.O. Box 2215, Terminal Annex, Los Angeles 54.*

Dust and Fume Control System

Sixty different plant installations, from a wide variety of major industries, are illustrated and described in a new three-color, 52-page Dust & Fume Controls Systems catalog published by The Kirk & Blum Mfg. Co.



Special sections detail Kirk & Blum's Series "C" centrifugal collectors, Type "M" and Type "W" unit collectors, with complete specifications on all models. Featured also is the firm's Research and Development Center, utilizing full size equipment to determine the proper collector for any job.

Source: *Kirk & Blum Mfg. Co., Dept. AE, Cincinnati 9, Ohio.*

Knitted Mesh

"Knitted Mesh, Its Properties and Uses", are described in a folder written by A. M. Goodloe. Uses include air filter medium, resilient medium such as vibration eliminators, acoustical material, and insulation holder.

Source: *Metal Textile Corp., Div. of General Cable Corp., Dept. AE, 643 E. First Ave., Roselle, N. J.*

Maximum Exposure to Radioisotopes

National Bureau of Standards, U. S. Department of Commerce, is expected to release this month as NBS Handbook 69, a set of recommendations of the National Committee on Radiation Protection and Measurements entitled "Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water."

The recommendations are recommendations only and carry no legal implications requiring adoption.

Source, when available: *Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.*, in about two months.

Vibration and Noise Control

New, 8-page booklet K4E gives engineering specifications and performance data for 27 types of products for the control and measurement of machinery vibration, shock, and noise. Actual installation photos show a variety of equipment and tell how typical problems were solved.

Bulletin contains a detailed discussion of the relative merits of steel springs and organic materials as isolation media. Special feature is selector chart covering wide range of equipment, showing recommended and alternate methods of isolation; also indicating when concrete foundations are necessary.

Source: *The Korfund Co., Inc. Dept. AE, 48-53A 32nd Place, Long Island City 1, N. Y.*

For More Data

Use Communications Center, page 35, for requesting more information about articles, advertised products, literature, etc.

Chevrolet Foundry

(Continued from page 25)

that provides them with comfortable working conditions. It has been found that this indoctrination helps assure cooperation of production personnel in attaining proper operation of the ventilation system. In the final analysis, say Chevrolet ventilation engineers, these are the people for whose comfort and health industrial ventilation systems are engineered and installed. Personnel are taught that "effective industrial ventilation is the use of air to remove unwanted materials and the replacement of that air with a relatively clean fresh air to provide a healthful, comfortable climate for the worker." END.

Unit Ventilator

(Continued from page 27)

of preparation of the wall surface for thermostat mounting is eliminated, and the cost of mounting the sensing element in the unit ventilator is generally less than that of field mounting of a wall type thermostat. With the many recognized factors which contribute to the need for expansion and upgrading of our schools, coupled with limited budgets and the rising costs of building construction, it is refreshing to observe an area where better performance is obtained with a decrease in cost. END.

Make-up Air Techniques

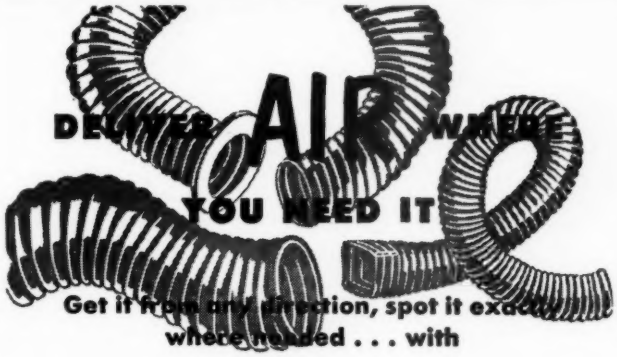
(Continued from page 34)

air from outside, pressurizing these areas to keep out foundry dust.

The core room, cleaning room and foundry section each has its own independent exhaust system. Because these systems operate independently of each other and at different periods, it was decided that each area should have its own make-up system. Each system is electrically tied into the exhaust systems so they operate when exhaust systems operate, yet can be used separately for summer or general ventilation as required. One of the foundry make-up units is installed in line with the loading dock to temper the increased infiltration expected at that point during operation of the exhaust systems.

In this foundry, make-up air is introduced in the cleanest area, permitting it to pick up objectionable materials as it progresses towards the area of exhaust. Several of the make-up systems, however, are installed immediately adjacent to the pouring and shakeout areas to effect positive displacement of contaminated atmospheres developing at these points.

The principal heating plants, for the core room, cleaning room and foundry section, are sized to handle the heat load when those areas are not affected by operation of the exhaust systems. END.



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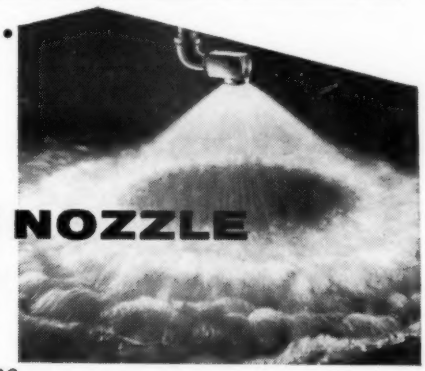

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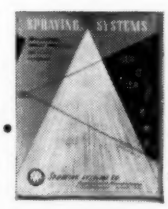

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And . . . for complete spray nozzle information, write for Catalog 24.

New Appointments

Trane Co., La Crosse, Wis., has announced the appointments of:

William C. Lindsay as sales manager of Packaged Equipment department responsible for the commercial and residential "Climate Changer" line of air conditioners. He joined Trane in July, 1958 as a member of the residential Climate Changer sales department.

Wesley M. Wright as assistant manager, "CenTraVac" sales department. He joined Trane in June, 1957 as a sales engineer.

Ian M. Dennis as sales engineer of residential and self-contained air conditioning equipment in its Newark, N. J. sales office. He has 14 years experience in the air conditioning field.

George Heard, former manager of Dravo Corp.'s contract department in heating and air conditioning, has been elected president of Safety First Supply Co., manufacturer and distributor of safety equipment for industry.

Appointment of **William P. Tennity** of Tennity & Co., Inc., Los Angeles, to handle its line of evaporative condensers and cooling towers in southern California and southern Nevada was announced by Baltimore Aircoil Co., Inc.

W. P. Tennity

David A. Nurse and **Kenneth Watts** from the recently dissolved Holland-Nurse Co., which had previously represented Baltimore Aircoil in the territory, are now associated with Tennity and will continue to serve the territory.

New appointments of sales engineer representatives for Photomation, Inc., (formerly ESS Instrument Co.), Bergenfield, N. J. include Chapman Engineering Sales, Cincinnati; Landes, Zachary & Peterson Co., Denver; J. Neal & Co., Miami, Fla.; Sight and Sound, Beaverton, Ore.; William Hagan, Levittown, Pa.; A. J. Warner Co., Minneapolis; Whitson Engineering Co., Dallas; John Williams Co., Seattle; Industrial & Textile Supply Co., Charlotte, N. C.; and Meters and Controls, Inc., Chicago.

W. Fay

W. Scott

William Fay and **Warren Scott** have been appointed to newly created posts in Minneapolis-Honeywell Regulator Co.'s Temperature Controls Group.

Fay is chief design engineer for the TCG panel division in Minneapolis, while Scott is product manager for residential air conditioning and low-voltage thermostats.

Fay will supervise the design of residential air conditioning control panels, centralized controls centers for commercial buildings, Supervisory DataCenters, and specialized control panels for industrial applications.

Scott, who joined Honeywell in 1950, most recently has served as application engineer on air conditioning and low-voltage thermostats.

Fay joined Honeywell in 1945 and for the last three years has been assistant market manager for residential air conditioning.

American Air Filter Co. Louisville, Ky. has appointed **R. M. Toucey** as exclusive representative in the Pittsburgh area for its Herman Nelson unit ventilator products for schools, Herman Nelson heating and ventilating products, and Illinois Engineering Div. heating systems and controls.

R. M. Toucey

Toucey, formerly a manufacturer's representative, was joined by **Roy Sheriff,** formerly with Robinson-Stanger, Pittsburgh, and **Tom Arthur,** from AAF's home office in Louisville.

Stanton W. Smith has been appointed Milwaukee office manager of Ilg Electric Ventilating Co., Chicago. Before his new appointment, Smith was assigned to the Ilg sales office in Cincinnati.

Richard Bennett has been named regional sales manager for the Chicago area for Torit Mfg. Co., St. Paul, Minn.

Bennett will supervise sales activities for Torit's industrial dust collectors and associated equipment in Chicago and its neighboring industrial area. The E. A. Davenport organization, Chicago, will continue as manufacturers' representative for Torit.

Bennett comes to Torit from Voss Machinery Co., Pittsburgh.

Alwin B. Newton, director of engineering of the York Div. of Borg-Warner Corp., has also been named a vice president of the company.

A. B. Newton

York President Henry Haase said the appointment was in keeping with the many contributions Newton is making to the engineering and research programs for the firm's air conditioning, heating, and refrigeration products.

C. Gilmore Ruston has been named vice president, field operations of Amstan Supply, Div. of American-Standard, Pittsburgh. In this newly created position, Ruston will supervise, through regional managers, 68 Amstan branch and warehouse operations in the United States. Ruston was previously marketing manager.

Sterling & Newby, which represents Marlo Coil Co. in Houston, Texas, has been appointed sales agent for Marlo air conditioning and heat transfer products in the Dallas area. **Ira P. Newby** heads the Dallas office.

Norman Reitman has been appointed advertising and sales promotion manager for Typhoon Air Conditioning Co., Div. of Hupp Corp., it was announced by John A. Gilbreath, vice president in charge of sales for the division.

Reitman, who has 10 years' experience in the advertising and marketing fields, was previously with L & P Electric Co. and its affiliate, Apparatus Distributors Inc., New York City.

I.B.M. Computer Building

(Continued from page 39)

top fin tube radiation is installed under the continuous sash in the manufacturing building. The administration building and engineering buildings are girdled with industrial baseboard radiation. Control of the various hot water heating zones is by window thermostats. END.

Dust Free Air

(Continued from page 31)

establishing requirements for a dust free area. The selection of correct air filters and the design of a proper air conditioning system is the heart of any successful dust free area. However, even the best of filters and the most careful designs can be vitiated if room design, personnel, and material handling techniques are not given careful consideration.

The author wishes to acknowledge the invaluable assistance of the following gentlemen who supplied data and photographs and who kindly reviewed this manuscript:

Mr. Arthur Baker, The Baker Co., Biddeford, Me.
Mr. H. B. Van Dorn, Fafnir Bearing Company, New Britain, Conn.
Mr. R. S. Baldwin, The Barden Corp., Danbury, Conn.
Mr. Carl Schmid, Kearfott Co., Inc., Little Falls, N. J.

Titanium Dust

(Continued from page 47)

Action of the washer is indicated in Figure 3. Water is introduced at the inlet of the collector where dynamic action of the fan mixes the water, dust and air. The thoroughly wetted titanium dust particles then travel in an upward spiralling path through two sets of vanes against a continual flow of water. The fine particles are completely washed out of the air stream and collected in the form of a slurry in the dewatering tank beneath the washer. The cleaned air continues its upward path and impinges against a third set of vanes which knock out the residual wash liquid entrained in the air stream. The clean air exhausts through the stack to the outside atmosphere.

The titanium dust is separated from the wash water in the dewatering tank by settling. The dense sludge of dust particles is continuously discharged from the tank by a drag conveyor. Since the titanium dust has no commercial value it is not reclaimed.

More than 99 percent of the titanium dust is collected in the wet dust control system described.

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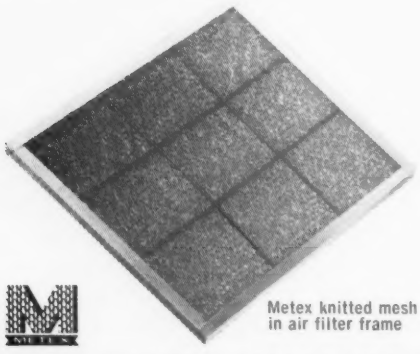
Cutting knitted mesh for air filter



Metex knitted mesh in air filter frame

METAL TEXTILE CORPORATION
ROSELLE, NEW JERSEY
...world's largest and oldest producer of knitted wire products
A DIVISION OF GENERAL CABLE CORPORATION

Lateral Ventilation

(Continued from page 21)

Calculations: Assuming exhaust along 8 ft. sides, W/L equals .25. From Table 1, required cfm/sq. ft. for 100 fpm control velocity = 170, but solution is 180 F, and corrosive; therefore use 170 x 1.5 or 225 cfm/sq. ft. of surface. Thus the required total exhaust from the tank should be 255 x 8 x 2 or 4080 cfm. From catalogued performance data we find that an 18 in. exhaust fan will deliver 4150 cfm at 7/8 in. s.p. (in addition to one head loss to atmosphere), or 4080 cfm at 0.9 in. s.p.

We can assume 4080 cfm at 0.9 in. s.p.

Manifold pressure loss = 2.3 Hv

$$\text{Duct loss} = \frac{4}{3}\times\frac{40}{\sqrt{4080}} = \frac{4}{3}\times\frac{40}{64} = 0.8$$

Elbows: 2 x 0.6 = 1.2
Weather top loss: 0.5

Sum = 4.8 Hv

Then, Ao = 36 x 4080/1000 x $\sqrt{4.8/.9}$ = 339 sq. in. or 20.8 in. dia. (use 21 in.), and each side duct will have an area of 339 sq. in. with slot length 96 in. long and slot height = 339/2 x 96 = 1.77 in. or 1¾ in.

Actually, using this rough design formula, the system will not quite handle 4080 cfm, but the design volume has an adequate factor of safety. Each side duct may be 10 in. x 34 in. END.

EQUIPMENT INSTALLED

Fans and Ventilator: *De Bothezat Fans Division, American Machine and Metals, Inc.*

Hoods: *Wallin Engineering Sales Company*

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